

**Assessment
of the
1998 Environmental Management Industry**

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EXECUTIVE SUMMARY

In 1998, U.S. companies generated \$190 billion in environmental industry revenue worldwide (Figure E-1). This figure represents a growth of only 2.0% during a year in which the current dollar Gross Domestic Product (GDP) increased 5.5% and the inflation rate was 1.6%. Growth exceeding the GDP increase was seen in 2 of 14 industry segments, and significant reduction was seen in 1 segment (Figure E-2). Growth in the remaining 11 industry segments was between -2.2% and 4.9%.

The two best performers, unchanged from last year, were Environmental Energy Sources (+12.2%) and Process and Prevention Technology (+6.7%). These also are among the smallest segments of the market at \$3.04 billion and \$0.96 billion, respectively. As in previous years, growth in the Environmental Energy Sources segment was led by the photovoltaic solar and wind energy businesses, which posted more than

30% and 20% gains, respectively. Water Equipment and Chemicals (\$19.11 billion), Water Utilities (\$28.83 billion), and Air Pollution Control Equipment (\$16.53 billion), which account for almost 34% of the total market, were the workhorse segments with solid, albeit not spectacular, 4.9%, 4.8%, and 4.7% growth, respectively. Wastewater Treatment Works (\$25.58 billion), Solid Waste Management (\$36.10 billion), and Consulting and Engineering (\$15.78 billion) also grew faster than inflation with growth rates of 3.4%, 3.4%, and 3.1%, respectively.

Three market segments (Resource Recovery, Hazardous Waste Management, and Remediation/Industrial Services) declined in 1998. The only large decline was in Resource Recovery (\$13.25 billion), which posted a 13.2% decline (more than \$2 billion) as commodity prices brought down the value of recyclables. In

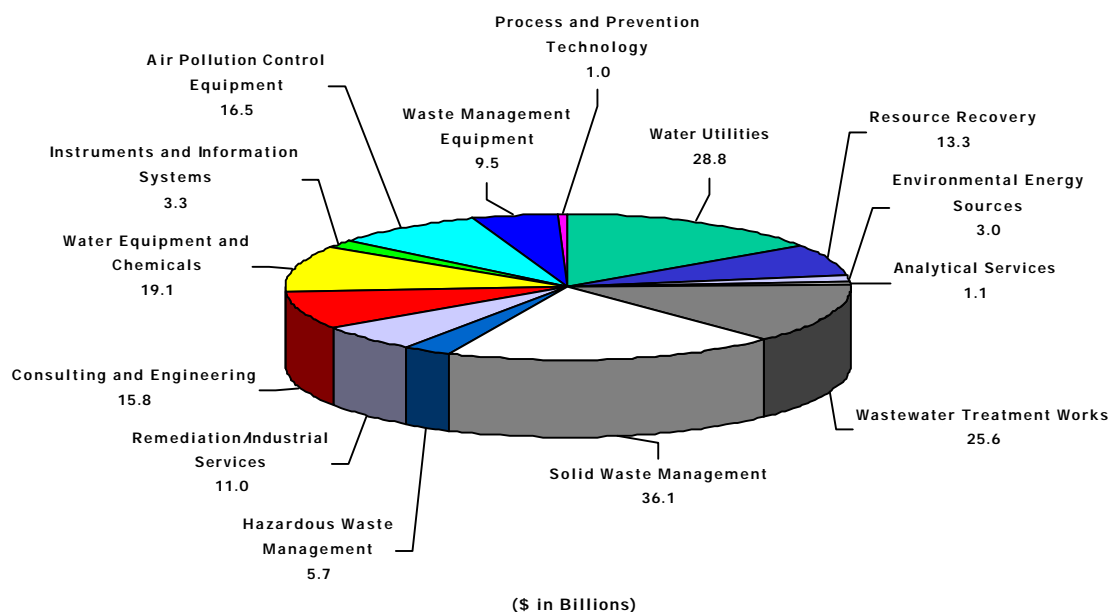


Figure E-1. The \$190 billion 1998 U.S. environmental industry. (Revenues generated by U.S. companies worldwide).
 Source: *Environmental Business Journal*® XII(5/6) 1999.

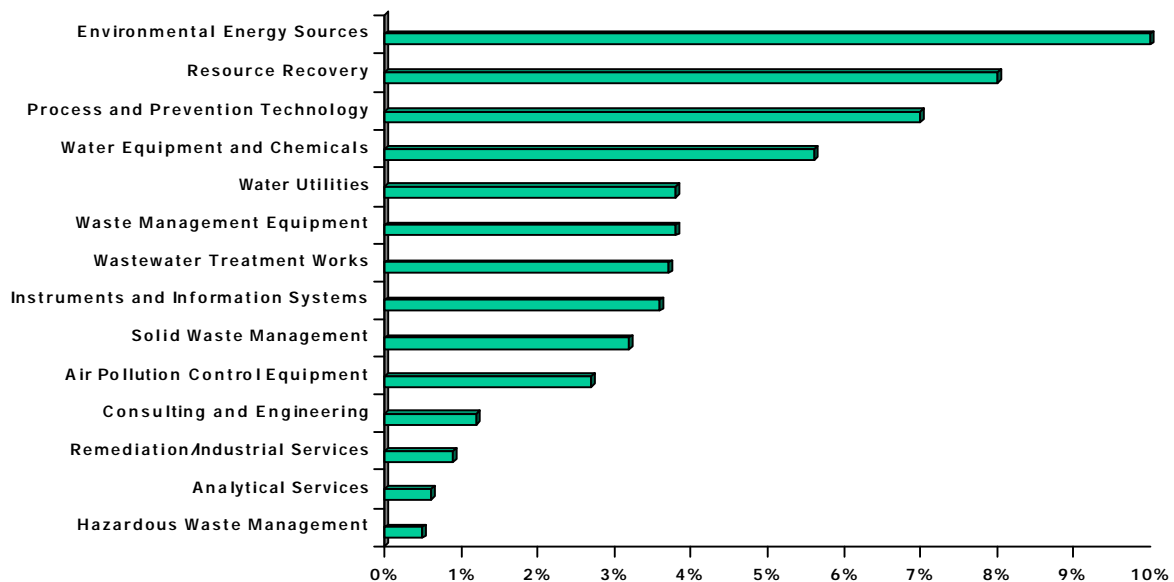


Figure E-2. U.S. environmental industry revenue growth in 1998 by environmental industry segment. *Source: Environmental Business Journal® XII(5/6) 1999.*

addition, Hazardous Waste Management (\$5.67 billion) continued the decline it began in 1993 and showed a 2.2% loss. The Remediation/Industrial Services segment (\$11.01 billion) continued the slow decline it began in 1997. However, revenue declines for these latter two segments were less than in previous years.

Projections for future growth of the U.S. environmental industry are also lackluster: Environmental Business International, Inc., (EBI) projects an average annual growth of 3.7% from 1999–2002. Figure E-3 presents projected annual growth in the U.S. environmental industry by market segment.

Looking at the U.S. site remediation market in particular, while the overall size of the remediation market has not changed dramatically over the past several years, the nature of the market and the major players have changed significantly (Table E-1 and Figure E-4). Department of Energy (DOE) spending is rising, Superfund and underground storage tank markets are declining, the Department of Defense (DOD) is reducing remediation spending to pay for military readiness, and private markets are expanding for property transfer.

Contrary to expectations, much of the growth in the remediation market has occurred in the consulting area as a result of the shift toward risk-based corrective action (RBCA) in many states. The broad emergence of RBCA programs since 1996 has driven strong gains in both the assessment and the private/nonregulatory portions of the remediation market. In the private market and the related brownfields area, the number of sites being addressed has tripled from 5 years ago as the economy has expanded and risk-based and reuse standards have opened a redevelopment window.

The DOE represents the largest part of the U.S. site remediation market, 30% of the total in 1998 (Figure E-4). Work for DOE continues to increase, growing to more than 40% of the U.S. remediation market in 2000 and offsetting the continuing decline in DOD remediation expenditures. DOE spent \$1.85 billion in 1998 in subcontracts with commercial firms for site remediation, which is an almost 7% increase over 1997 and more than double the 1992 level. This expenditure is almost

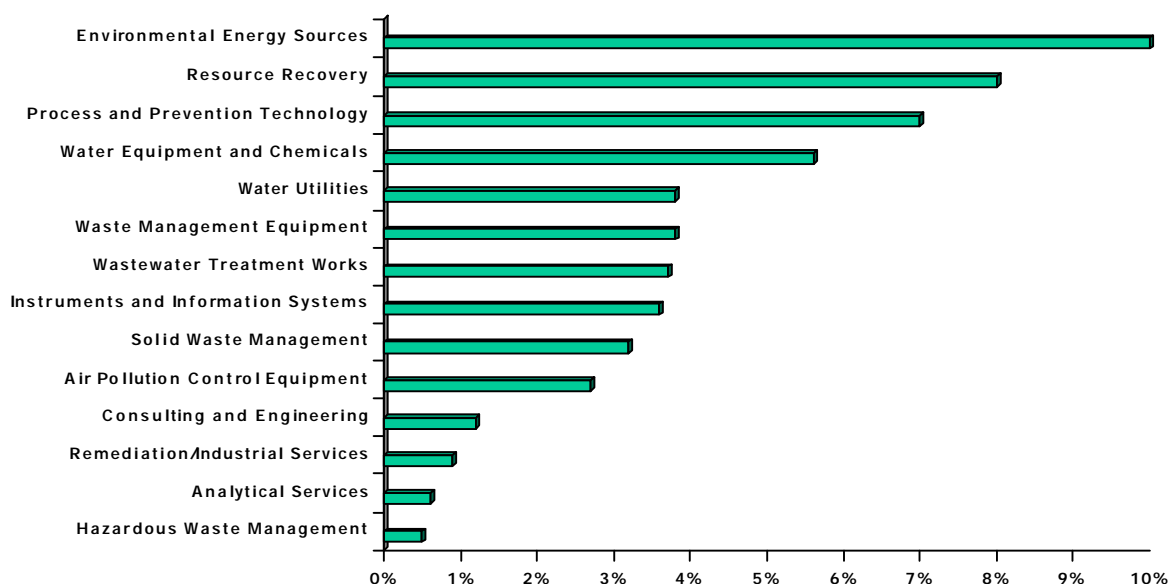


Figure E-3. Projected annual growth (1999–2002) in the U.S. environmental industry by market segment. *Source: Environmental Business Journal® XII(5/6) 1999.*

Table E-1. The U.S. site remediation market, 1992 through 1998
(in millions of dollars and as a percentage)

| | 1992 (\$) | 1992 (%) | 1994 (\$) | 1994 (%) | 1996 (\$) | 1996 (%) | 1997 (\$) | 1997 (%) | 1998 (\$) | 1998 (%) |
|---|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
| Remediation construction | 2,688 | 42 | 3,275 | 53 | 3,561 | 58 | 3,517 | 59 | 3,483 | 57 |
| Site assessments and RI/FS ^a | 2,112 | 33 | 1,282 | 21 | 1,128 | 18 | 1,128 | 19 | 1,344 | 22 |
| Remedial design | 1,152 | 18 | 1,125 | 18 | 1,010 | 17 | 923 | 15 | 794 | 13 |
| Closure and monitoring | 448 | 7 | 448 | 7 | 401 | 7 | 402 | 7 | 489 | 8 |
| Total | 6,400 | | 6,130 | | 6,100 | | 5,970 | | 6,110 | |

Source: Environmental Business Journal® XII(1/2) 1999.

^aRI/FS = remedial investigation/feasibility study.

double that of DOD's \$940 million expenditure. DOE funding to commercial subcontractors is expected to continue to increase for the next 10 to 15 years as facility decontamination and decommissioning projects fill in when site remediation activities begin to dwindle. In addition, growth in private markets, due mostly to the health of the economy and the advent of low-cost remediation, is forecast to keep the remediation market growing.

Ongoing consolidation, effected through mergers and acquisitions, continues to be perhaps the single clearest trend in the environmental industry. Consolidation gained momentum during 1998 and the first half of 1999, and the merger and acquisition "frenzy" is expected to continue through 2000. To understand the extent of consolidation, Farkas Berkowitz & Company compared market share among remediation market competitors in 1994 and 1998. The share

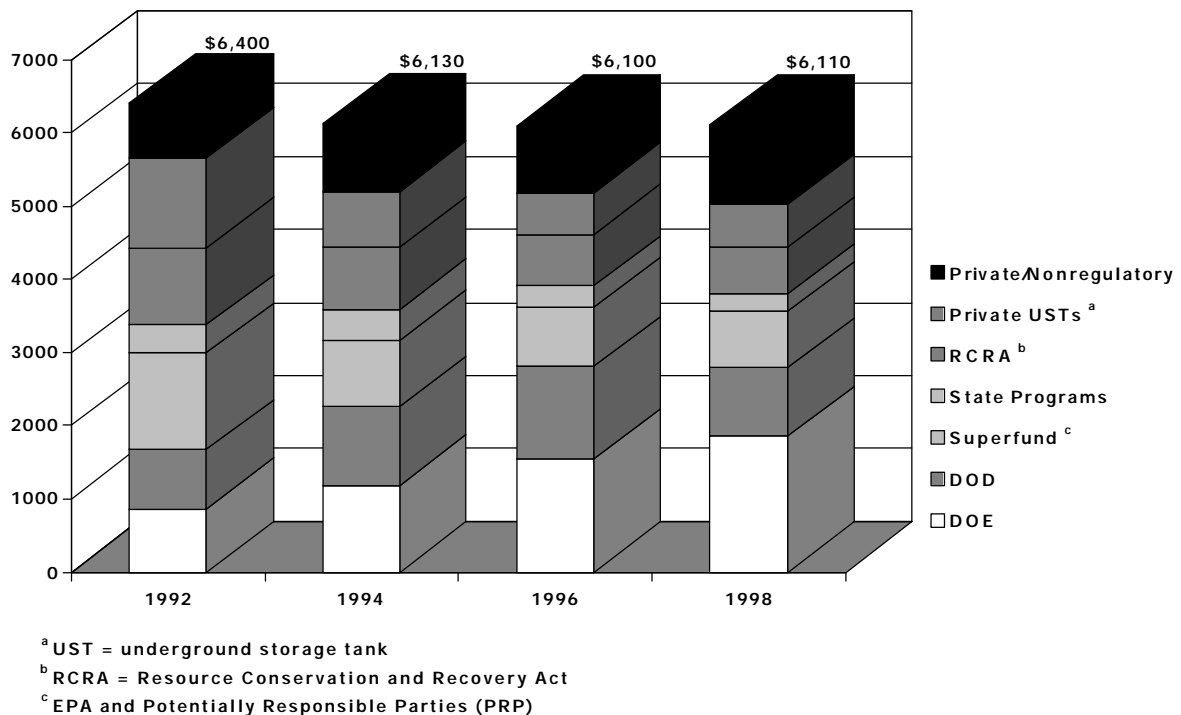


Figure E-4. DOE is now the largest customer in the U.S. site remediation market (in millions of dollars). Source: *Environmental Business Journal*® XII(1/2) 1999.

of market claimed by the top 10 companies increased by nearly a third from 38% in 1994 to 50% in 1999. In addition to mergers and acquisitions, another factor driving this change is the large DOE projects coming on-line, fueling the growth of those contractors. Finally, there has been some attrition at the bottom with 20 to 25% fewer small firms still operating in the remediation business from 1993 to 1998. EBI estimates about 550 firms have significant operations in remediation, down from more than 700 in 1995. Similar dramatic stories of consolidation can be told about the other environmental industry market segments.

The international market continues to be an important growth area. Both the number of firms competing in the international marketplace and revenues continue to increase. Export activity continued to grow in 1998, although certainly not at the rate seen in the past. So great had been export growth, that revenues from outside the United States were responsible for over one-half of the total growth in the U.S. environmental

industry from 1994–1997. However, in 1998 the globalization of the U.S. environmental industry slowed due to economic setbacks facing many countries. Exports of goods and services grew only 4% in 1998 to \$18.9 billion. While the U.S. share of non-U.S. markets nudged up slightly to 6.2%, other nations stepped up efforts to penetrate the U.S. environmental market through partnerships, acquisitions, and direct sales. As a result, the trade surplus declined, from \$8.5 billion in 1997 to \$8.0 billion in 1998.

The U.S. Department of Commerce report entitled *Meeting the Challenge: The U.S. Environmental Industry Faces the 21st Century* characterizes the industry as maturing, marked by slowing growth, heightened competition, pricing pressures, and reduced profitability. However, major global problems still exist (such as resource depletion, global climate change, ozone depletion, declining water quality, poor air quality, and rising cancer rates) and will stimulate growth in the industry. For example, major new expenditures by the Administration to address climate change will help

underwrite an expansion of such areas of the environmental industry as renewable energy sources, clean cars, and energy-efficient buildings. Over time, a transition of the environmental industry to address new priorities is inevitable. Also over the long term, environmental and

economic policy reform and regulations will almost certainly play a role in the future of the environmental industry. But for now, environmental companies continue to look to restructuring, mergers and acquisitions, and the export market for sustainability.

1

OVERVIEW OF THE U.S. ENVIRONMENTAL INDUSTRY

This report provides updated information for the environmental management industry infrastructure study sponsored by the U.S. Department of Energy's (DOE's) Environmental Management (EM) Office of Science and Technology. The purpose of this report is to inform DOE decision makers about the U.S. environmental industry. The information in this report was produced using market studies and information resources that reflect industry views.

Environmental industry information condensed and summarized for this report was taken from these key sources: *Environmental Business Journal*® (EBJ), published by Environmental Business International, Inc. (EBI); *EBI Report 312B*, "Remediation and Industrial Services - Overview of Markets and Competition," by EBI; and *The Eleventh Annual State-of-the-Industry Report*, by Farkas Berkowitz & Company. Supplementary information can be found in the Envirobiz™ International Environmental Information Network™ World Wide Web site at URL <http://www.envirobiz.com/>; in the *GNet Global Network of Environment & Technology* World Wide Web site at URL <http://www.gnet.org/>; and in the U.S. Department of Commerce *Stat-USA Internet* World Wide Web site at URL <http://www.stat-usa.gov/>. Readers interested in more detailed information should refer to these source documents and to others cited at the end of this report.

Section 1 reviews the state of the environmental industry in the United States in 1998 and includes separate sections on each of the major industry segments. A Market Overview in each section is followed by Trends and Outlook. Section 2 provides more in-depth discussion of key trends in the industry. Definitions of the environmental industry and its segments vary widely among analysts. To maintain consistency and present a

coherent picture throughout this report, all revenue estimates are derived from a single source: EBI. Analysis and discussion of market trends draw from a variety of sources, however.

1.1 1998 Market Overview

In 1998, \$190 billion in environmental industry revenue was generated by U.S. companies worldwide (Figure 1). This amount is 2.0% greater than 1997 revenues and represents a barely perceptible improvement in a year with 1.6% inflation (Consumer Price Index) and a 5.5% increase in Gross Domestic Product (GDP). Growth exceeding the GDP was seen in 2 of 14 industry segments, and significant reduction was seen in 1 segment (Figure 2). Growth in the remaining 11 industry segments was between -2.2% and 4.9%.

The two best performers, unchanged from last year, were Environmental Energy Sources (+12.2%) and Process and Prevention Technology (+6.7%); these segments also were among the smallest segments of the market at \$3.04 billion and \$0.96 billion, respectively. Resource Recovery, which posted a 6.3% increase in 1997, showed a 13.2% decline (more than \$2 billion) to \$13.25 billion in 1998 as commodity prices brought down the value of recyclables. Hazardous Waste Management (\$5.67 billion) continued the decline it began in 1993 and showed a 2.2% loss. The Remediation/Industrial Services segment (\$11.01 billion) continued the slow decline it began in 1997.

Water Equipment and Chemicals (\$19.11 billion), Water Utilities (\$28.83 billion), and Air Pollution Control Equipment (\$16.53 billion), which account for almost 34% of the total market, were

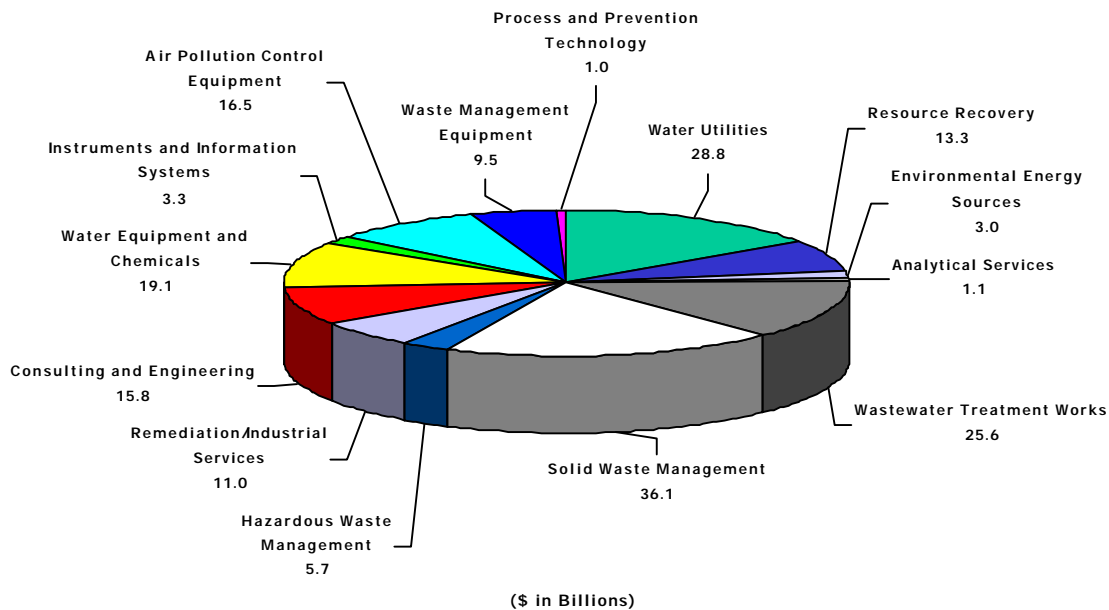


Figure 1. The \$190 billion 1998 U.S. environmental industry. (Revenues generated by U.S. companies worldwide).
Source: Environmental Business Journal® XII(5/6) 1999.

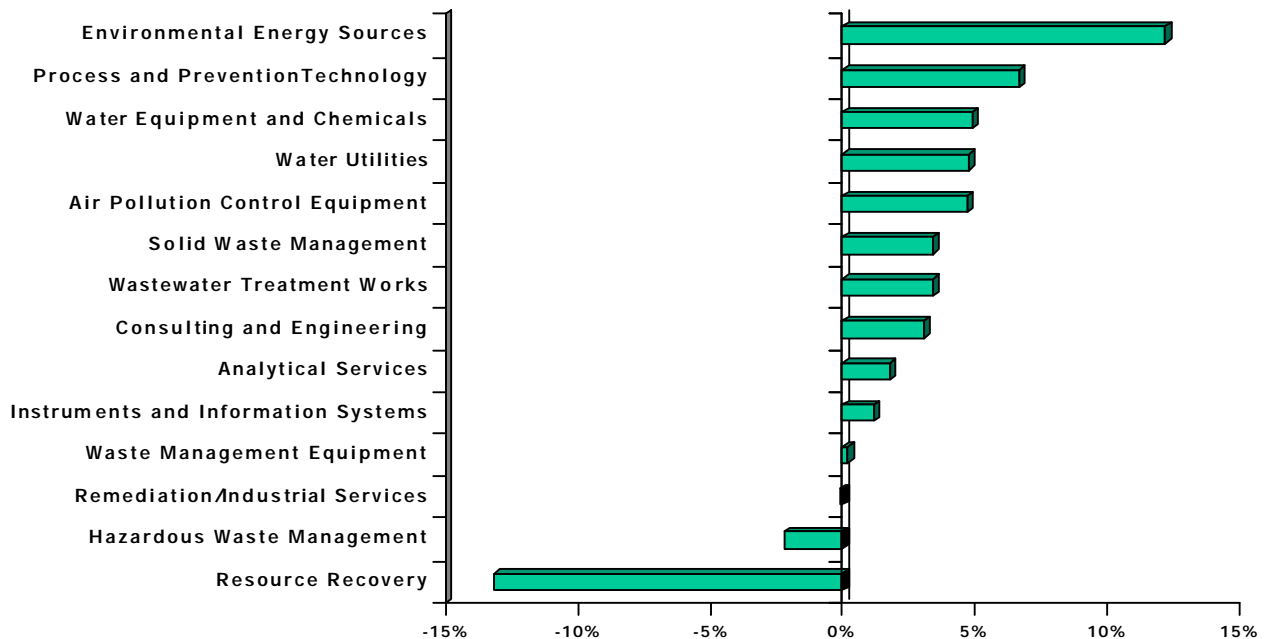


Figure 2. U.S. environmental industry revenue growth in 1998 by environmental industry segment. *Source: Environmental Business Journal® XII(5/6) 1999.*

the workhorse segments that beat inflation with solid, albeit not spectacular, 4.9%, 4.8%, and 4.7% growth, respectively. Wastewater Treatment Works (\$25.58 billion), Solid Waste Management (\$36.10 billion), and Consulting and Engineering (\$15.78 billion) also grew faster than inflation with

growth rates of 3.4%, 3.4%, and 3.1%, respectively.

Projected annual growth (1999–2002) for the 14 U.S. environmental industry segments defined by EBI is illustrated in Figure 3. Significant growth

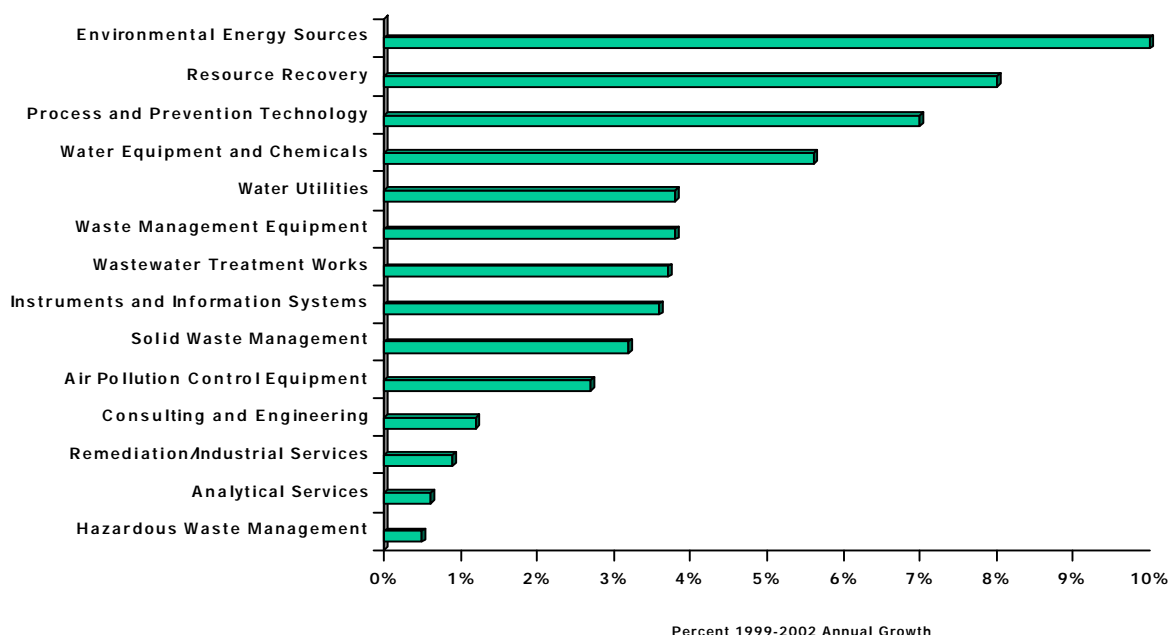


Figure 3. Projected annual growth (1999-2002) in the U.S. environmental industry by market segment. *Source: Environmental Business Journal® XII(5/6) 1999.*

is projected for Environmental Energy Sources (10%), Resource Recovery (8.0%), Process and Prevention Technology (7.0%), and Water Equipment and Chemicals (5.6%). Very slow growth is projected for Consulting and Engineering (1.2%), Remediation/Industrial Services (0.9%), Analytical Services (0.6%), and Hazardous Waste Management (0.5%).

Exports now account for \$18.9 billion, or 10% of U.S. environmental industry revenues. As a result of regional economic crises, non-U.S. revenues ended their spectacular growth and showed only a 4% growth over 1997 after an average growth rate at 18% the previous 4 years.

The following sections provide more detailed market overviews, identify key trends, and provide outlooks for the major environmental industry segments.

1.2 Remediation/Industrial Services

Market Overview

The Remediation/Industrial Services segment (\$11.01 billion) continued the slow decline it began in 1997 and posted a 0.1% decline in 1998. Although the segment posted a small loss, the revenue decline was less than in previous years (Figure 4). The Remediation/Industrial Services segment consists of two major subsegments:

- site remediation involves construction work performed at contaminated sites by remediation contractors;
- industrial services includes primarily facility cleaning services (refinery turnaround; cleaning, repair, and maintenance of aboveground storage tanks; and cleaning services for containers, manufacturing

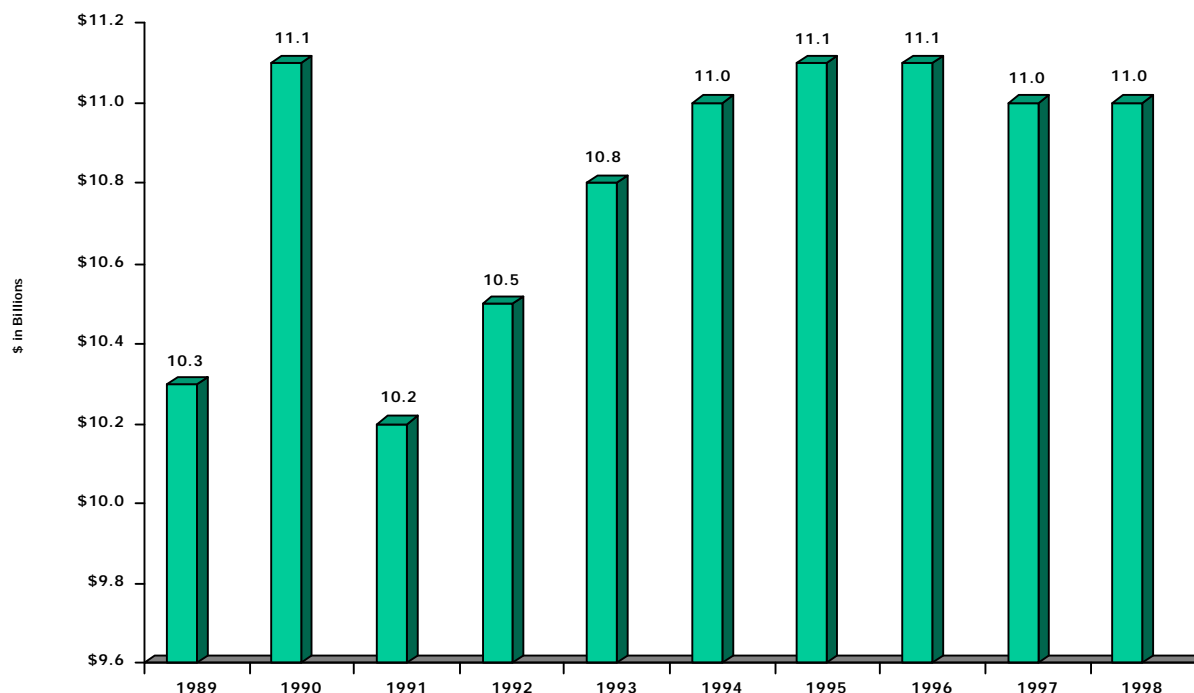


Figure 4. Revenue generation in the U.S. environmental remediation/industrial services market, 1989–1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*

facilities, and industrial or commercial sites like airports) and abatement services for cleaning buildings of hazardous materials such as asbestos and lead paint and for radon mitigation.

Overall site remediation revenues increased 2.5% in 1998. However, the majority of this market segment, which is made up of industrial services contractors, faced flat or declining markets as both the oil and asbestos businesses continued to be flat or declining [EBJ XII(5/6) 1999].

Trends

The remediation business generates revenues from several environmental segments defined by EBI and used here; they include Analytical Services, Consulting and Engineering, and Remediation/Industrial Services [EBI Report 312B 1997]. The following discussion refers to the overall site remediation market [as defined in EBJ XII(1/2) 1999], combining elements of each of these segments. Although the size of the U.S. remediation market has not shown much change over the past several years, the nature of the market

and the major players have changed significantly. DOE spending is rising, Superfund and underground storage tank markets are declining, the Department of Defense (DOD) is reducing remediation spending to pay for military readiness, and private markets are expanding for property transfer [Paterson 2000]. Table 1 and Figure 5 summarize the changes that are occurring in the U.S. site remediation market.

Site remediation contractors have experienced fairly flat markets overall and gained 2.3% in 1998. Much of this growth came in the consulting area and resulted from the increase in risk-based corrective action (RBCA) in many states. The broad emergence of RBCA programs since 1996 has driven strong gains in both the assessment and the private/nonregulatory portions of the remediation market.

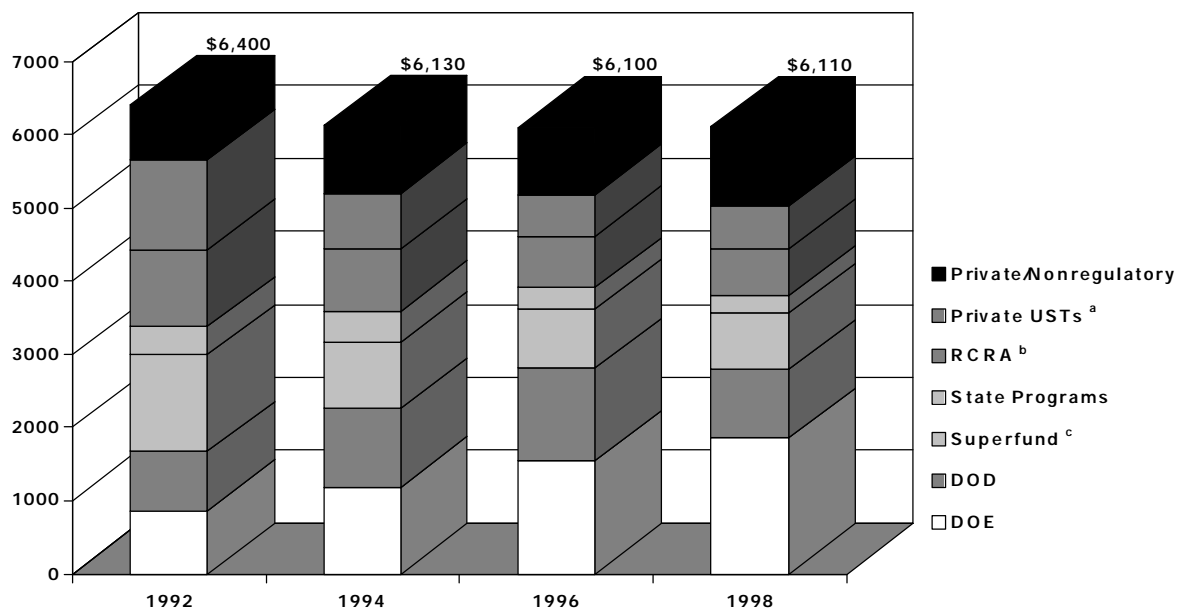
The largest part of the U.S. site remediation market, 30% of the total, is DOE work (Figure 5). Work for DOE continues to increase, growing to more than 40% of the U.S. remediation market in 2000 and offsetting the continuing decline in

Table 1. The U.S. site remediation market, 1992 through 1998
(in millions of dollars and as a percentage)

| | 1992 (\$) | 1992 (%) | 1994 (\$) | 1994 (%) | 1996 (\$) | 1996 (%) | 1997 (\$) | 1997 (%) | 1998 (\$) | 1998 (%) |
|---|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
| Remediation construction | 2,688 | 42 | 3,275 | 53 | 3,561 | 58 | 3,517 | 59 | 3,483 | 57 |
| Site assessments and RI/FS ^a | 2,112 | 33 | 1,282 | 21 | 1,128 | 18 | 1,128 | 19 | 1,344 | 22 |
| Remedial design | 1,152 | 18 | 1,125 | 18 | 1,010 | 17 | 923 | 15 | 794 | 13 |
| Closure and monitoring | 448 | 7 | 448 | 7 | 401 | 7 | 402 | 7 | 489 | 8 |
| Total | 6,400 | | 6,130 | | 6,100 | | 5,970 | | 6,110 | |

Source: *Environmental Business Journal*® XII(1/2) 1999.

^aRI/FS = remedial investigation/feasibility study.



^a UST = underground storage tank

^b RCRA = Resource Conservation and Recovery Act

^c EPA and Potentially Responsible Parties (PRP)

Figure 5. DOE is now the largest customer in the U.S. site remediation market (in millions of dollars). Source: *Environmental Business Journal*® XII(1/2) 1999.

DOD remediation expenditures [Paterson 2000]. DOE spent \$1.85 billion in 1998 in subcontracts with commercial firms for site remediation—an almost 7% increase over 1997 and more than double the 1992 level. This \$1.85 billion expenditure is almost double that of the \$940 million expenditure by DOD. DOE funding to commercial subcontractors is expected to continue to increase for the next decade. Facility decontamination and decommissioning projects are on the increase and make up for any reductions in site remediation work.

Along with these spending increases, there have been important changes in the way DOE does work. The DOE market has evolved into the hands of a few large contractors at the major sites, work has become increasingly project-oriented, and the use of novel procurement mechanisms and privatization has increased.

Environmental Protection Agency (EPA) markets [mainly Superfund and Resource Conservation and Recovery Act (RCRA)] have fallen from 37% of the site remediation market in 1992 to 24% in 1998. This decline has been accompanied by a shift to more flexible and results-driven approaches. With the progress made in site remediation in the last few years, the market is expected to continue its downslide. EPA has also contributed to the growing momentum in brownfields by leveraging development capital to develop more than 200 brownfields sites nationwide.

Within the site remediation subsegment, the underground storage tank market has seen the greatest reduction over the past several years, and revenues are less than half their 1992 level (see Figure 5). This reduction is mainly due to considerably fewer state-funded programs and to RBCA standards. There was some growth in 1998, however, as a result of a December 1998 tank upgrade deadline.

The largest growth area is the private market and the related brownfields area. The number of sites being addressed has tripled from 5 years ago as the

economy has expanded and risk-based and reuse standards have opened a redevelopment window.

In the technology area, the big trends are growths in in situ bioremediation for soil treatment, air stripping with off-gas treatment and air sparging for groundwater treatment, and the use of portable gas chromatographs and field instrumentation for site characterization. Excavation and off-site disposal experienced the largest decline, from 55% of soil treatment projects in 1992 to 24% of projects in 1998. In the site characterization area, “drill and sample” has experienced a large decline, from 74% of projects in 1992 to 63% of projects in 1998.

On the business side, consolidation gained momentum during 1998 and the first half of 1999, and the merger and acquisition frenzy is expected to continue through 2000. To understand the extent of consolidation, Farkas Berkowitz & Company compared market shares among remediation market competitors in 1994 and 1998. The share of market claimed by the top 10 companies increased by nearly one-third from 38% in 1994 to 50% in 1998. In addition to mergers and acquisitions, another factor driving this change is the large DOE projects coming on line, which is fueling the growth of those contractors. Finally, there has been some attrition at the bottom with 20 to 25% fewer small firms still operating in the remediation business from 1993 to 1998. EBI estimates 556 firms with significant operations in remediation, which is down from more than 700 in 1995.

The size of federal remediation contracts that are let to commercial firms is increasing from small site assessment and underground storage tank recovery work to large environmental management restoration contracts and performance-based management and integration contracts.¹ There are still many small projects, however. About 93% of remediation projects from which commercial providers derived revenues in 1996 were valued at

¹DOE currently has management and integration contracts in place at its Oak Ridge (Tennessee), Rocky Flats (Colorado), and Hanford (Washington) sites.

less than \$1 million and accounted for only 38% of total revenues.

Outlook

While growth prospects for the overall Remediation/Industrial Services segment are expected to average only a modest 0.9% per annum through 2002, prospects for site remediation are better. EBJ notes that growth in private markets, which is due mostly to the health of the economy and the advent of low-cost remediation, is forecast to keep the remediation market growing through at least 2000 [EBJ **XII**(1/2) 1999].

Growth of the site remediation sector is also fueled by the continuing trend for DOE to use commercial subcontractors for its remediation projects. DOE funding to commercial subcontractors is expected to continue to increase for the next 10 to 15 years as facility decontamination and decommissioning projects fill in when site remediation activities begin to dwindle. Factors that would be expected

to influence this growth rate, for good or ill, include the health of the U.S. economy; budgetary constraints on DOD, DOE, and EPA; regulatory uncertainty related to the Comprehensive Environmental Response, Compensation, and Liability Act and RCRA reauthorization; and the impact of waiting for improved technologies in hopes of a cheaper or more-effective solution [EBI Report **312B** 1997].

1.3 Hazardous Waste Management

Market Overview

Figure 6 shows \$5.67 billion in 1998 revenues in the Hazardous Waste Management segment, which is a continuation of losses in this market since the 1992 high of \$6.6 billion and which represents a 2.2% decrease from 1997 revenues. This segment consists of industrial hazardous waste, medical waste, and nuclear waste.

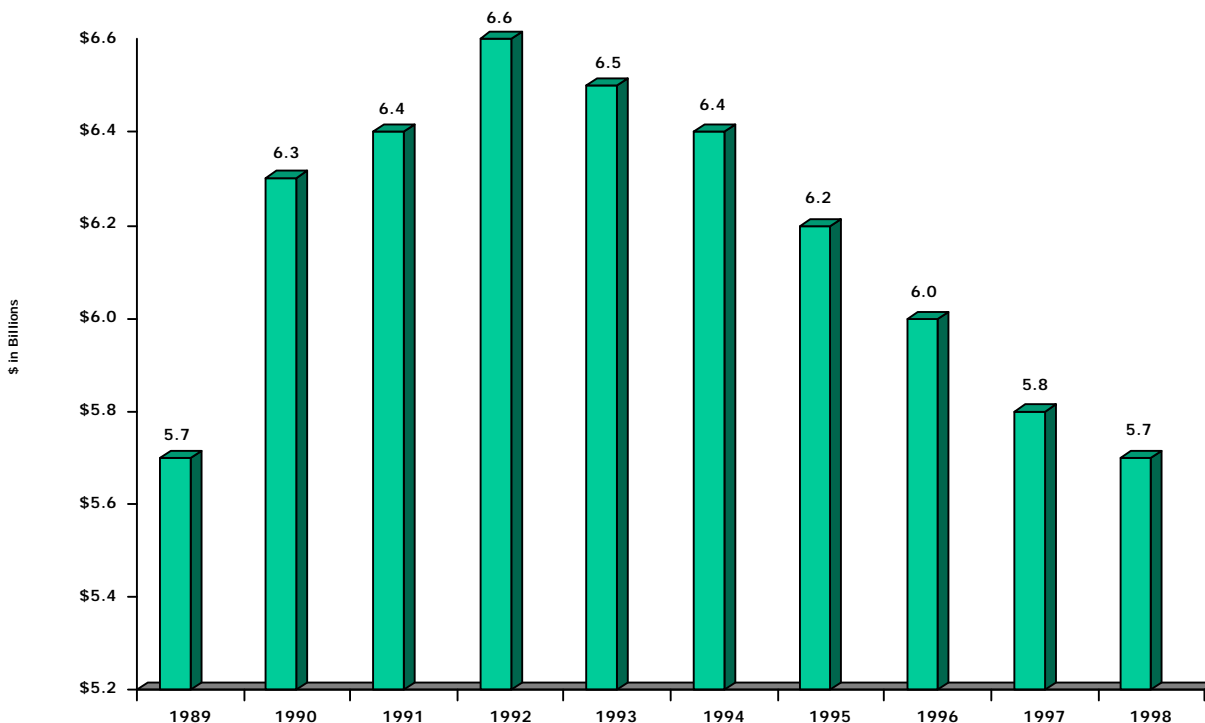


Figure 6. Revenue generation in the U.S. hazardous waste management services market, 1989B1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*

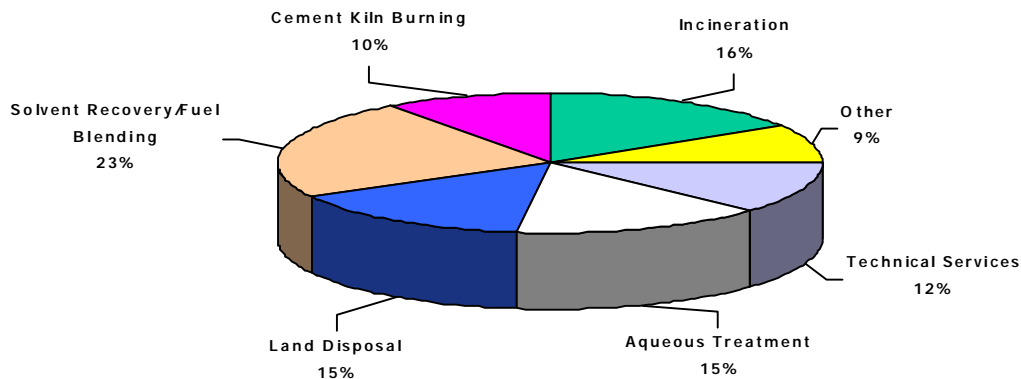


Figure 7. Distribution of the \$3 billion 1998 industrial hazardous waste market by type of service. *Source: Farkas Berkowitz 1999.*

The industrial hazardous waste subsegment accounts for \$3.2 billion of the total and for almost all of the Hazardous Waste Management segment's decline. The distribution of the industrial hazardous waste market by type of service is shown in Figure 7. Consolidation continues to be the big news in this subsegment; but while it promises more stability, financial performance is still uncertain because of the industry's over investment in capacity.

The medical waste subsegment, a \$1.3 billion commercial market, showed a modest gain over 1997. This subsegment has been fairly steady since prices stabilized in 1996. The nuclear waste subsegment remained flat at about \$1.2 billion in 1998.

Trends

In the medical waste business, volumes have grown about 3 to 4% per year over the past few years. Market growth has increased due to new rules promulgated in late 1998 under the Clean Air Act Amendments of 1990 that limit emissions of nine pollutants (particularly mercury and dioxin) from hospital incinerators. EPA estimates the rules will shut down more than one-half of the 2,400 hospital-run incinerators by the compliance deadline of 2002. Hospitals are moving to outsourcing, and it is expected that \$300 million in annual revenues will be added to this segment within the compliance time frame. Another important trend in the medical waste business is

consolidation at the top, where Stericycle is the leader following a series of acquisitions.

Nuclear waste management is forecast to grow in the 1% range for the next few years. The only subsegment experiencing growth is the volume-reduction business. Although the nuclear power industry is stagnant, a significant opportunity is presented by the prospect of decontaminating and decommissioning the nation's 108 nuclear reactors over the next 30 years.

In the industrial hazardous waste subsegment, EBJ reports good news in the form of reducing overcapacity and price stabilization. The future of this subsegment, however, is still uncertain. On the business side, consolidation remains the biggest story; following a series of mergers, leader Safety-Kleen posted revenues of \$1.7 billion in 1999—more than \$1 billion of which is directly related to industrial hazardous waste.

Outlook

EBI projects continued revenue losses in the Hazardous Waste Management segment at about 2.2% annually through 2002, with the losses fueled by continued overcapacity.

1.4 Consulting and Engineering

Market Overview

The \$15.8 billion Consulting and Engineering segment recovered from 4 years of stagnation to



Figure 8. Revenue generation in the U.S. environmental consulting and engineering market, 1989-1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*

show a 3.1% growth in 1998 (Figure 8) that was attributed largely to economic growth [EBJ XII(5/6) 1999]. Although the continuing absence of regulatory drivers was projected to result in declines in this segment, the segment has seen growth because economic prosperity produced more work for all types of consulting and engineering firms.

When the U.S. environmental Consulting and Engineering market segment is broken down by services, substantial growth in 1998 is seen in the areas of investigations, assessments, and audits, thus reversing a trend from the previous 3 years. This reversal is attributed to two factors. First, the booming economy has led to increased property development, industrial expenses, and merger and acquisition activity that have driven demand for more assessment work. Second, the emergence of risk assessment as a practice and of risk-based standards for site cleanup and redevelopment has led to an increase in assessment work. Reversing a negative trend in the past, risk assessment is on the increase for its ability to negotiate away site problems on behalf of clients. Other service

categories seeing growth include monitoring and information management services. Operation and maintenance has also increased, with water and wastewater markets the primary contributors.

Breaking down the U.S. environmental Consulting and Engineering market by media reveals that remediation and hazardous waste account for approximately one-half of this market segment (Figure 9). Water and wastewater together account for an additional 28% of the segment. Perhaps the biggest surprise in this segment is that remediation consulting revenues are up. The increases are almost exclusively from private sector clients and predominantly from work on sites where risk assessment can be applied to reduce cost. Reversing the expectations of declining remediation consulting revenues, the market is seeing increases as customers use consultants to plead their case to regulators to get cleanup standards and remediation requirements reduced. This trend is increasing the consulting business as it reduces the cost of remediation. Other media segments showing significant gain in 1998 were water quality and natural resources.

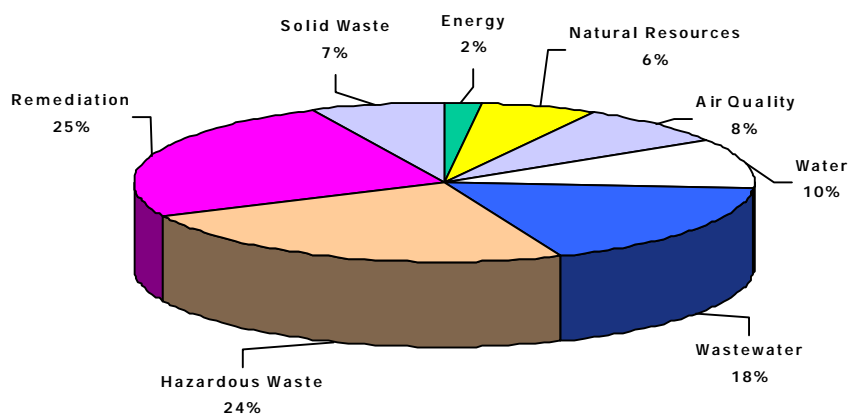


Figure 9. The \$15.8 billion 1998 U.S. environmental consulting and engineering market: revenue distribution among segments. Source: *Environmental Business Journal*® XII(3/4) 1999.

Broken down by customer, the Consulting and Engineering segment is 47% private sector and 53% government. It was the private sector markets that funded the Consulting and Engineering segment's resurgence in 1998. Government clients fell from 57% of the market in 1997 to 53% in 1998; the decline was mainly due to the reduction in federal business, particularly work for DOD [EBJ XII(3/4) 1999]. When looked at by region, 11% of revenues in the Consulting and Engineering segment are from non-U.S. markets, thus continuing the trend in growth in international revenues.

Consolidation and diversification continue to be the leading trends as firms struggle to redefine themselves. In part, the growth in this segment is due to the broadening and diversification of services offered by these firms. Environmental consulting and engineering companies are positioning themselves as more-integrated professional services providers engaged in operations, systems management, and outsourcing. The growing trend in mergers and acquisitions has led to the consolidation of the market in the hands of some very large (e.g., \$2 billion) firms.

Although companies in the market segment report a more favorable outlook than in years past, this in part reflects the attrition that has occurred in this segment. EBI's universe of the consulting and

engineering industry includes 3,800 firms, down almost 12% from the peak of 4,300 firms in 1993. Data compiled by Environmental Information Ltd. estimates a much higher closure rate of 39% of environmental service firms from 1993 to 1998 and 13% over the past 2 years. These numbers include the hazardous waste management and analytical services firms that have experienced an even greater downturn because of overcapacity and price competition. Even surviving firms experienced attrition: data from the Environmental Financial Consulting Group indicate that 70% of larger firms had layoffs in 1998. Environmental Financial Consulting Group's overall estimate is that 4% of industry personnel were laid off in 1998 [EBJ XII(3/4) 1999].

Trends

Mergers and acquisitions continue to be a major trend in the Consulting and Engineering segment. Consolidation has affected this segment to the extent that the top 25 firms represent over one-half the market, which is an increase from one-third at the beginning of the decade. Although the number of firms is diminishing, the business remains spread out with at least 3,800 U.S. firms [EBJ XII(5/6) 1999]. Merger and acquisition activity in the environmental Consulting and Engineering segment is projected to continue to increase in 1999 [EBJ XII(3/4) 1999].

Diversification, another strategy for dealing with the transition from a regulation-driven market, has had success with some companies. The Consulting and Engineering segment has the greatest potential within the environmental industry for success in diversification because of the wide range of applicability of the typical consultant/engineer's basic skills. Many firms are working to broaden their identity from environmental problem solvers to business solution providers. Services such as outsourcing, information management, property portfolio management, and operations and maintenance are all increasing as a logical extension of core competencies.

A fruitful area for international growth appears to be associated with feasibility studies and installation engineering for distributed power projects (e.g., gas turbines, diesel generators, and hybrid systems). The tightening of Clean Air Act emission standards in 2000 is expected to help the domestic consulting and engineering market because electric utilities that now rely on natural gas and coal need engineering assistance with fuel blending and retrofits [EBJ **XI**(3) 1998].

Outlook

The water and wastewater subsegments are projected to have the best outlook because of economic growth, municipal budget surpluses, and efforts to upgrade infrastructure. Information management is also predicted to be a growth area within the Consulting and Engineering segment. Growth is projected to occur largely in the private sector rather than government markets. And revenue growth in non-U.S. markets is forecast to far outstrip growth in U.S. markets.

While consulting and engineering firms are doing more with less and while growth and optimism have returned in 1998, EBI cautions that it is still the case that 60% of the business is based on functions resulting in nonrecurring revenue streams. EBI forecasts an average 1.2% annual growth in revenues in the Consulting and Engineering segment from 1999 to 2002 [EBJ **XII**(5/6) 1999].

1.5 Resource Recovery

Market Overview

The resource recovery business fell 13% in 1998 to \$13.3 billion from \$15.3 billion in 1997 (Figure 10). The decline in revenue in 1998 was due mainly to falling prices. The prices for scrap steel (the largest contributor to resource recovery revenues) fell 9% in 1998, aluminum cans fell 17%, aluminum scrap fell 12%, and paper fell 11%. However, 1999 has shown signs of a rebound. The scrap business has always fluctuated widely with commodities prices, and 1998 and 1999 are no exceptions [EBJ **XII**(5/6) 1999].

In 1998, steel imports flooded the United States and caused dropping prices, slower domestic production, and a lessening of the demand for scrap. Global demand for aluminum was also hit by the Asian crisis, which resulted in a downward effect on scrap prices. The demand for copper is impacted by overcapacity in metal mining and smelting.

Good news came in 1999, however, with significant increases in prices for aluminum cans, high-density polyethylene (HDPE) plastic, old corrugated cardboard, old newspaper, and white ledger paper. Overall in 1999, prices are up in every commodity except polyethylene terephthalate (PETE) plastic, and 1999 is expected to see revenues back in the range of 1995's peak when sales of recovered materials reached almost \$17 billion.

Trends

As in other segments of the environmental industry, one of the most important trends for the Resource Recovery segment is consolidation. The Asian crisis resulted in heavy imports of steel into the United States and a falloff in U.S. scrap prices of 40% in 6 months. This led to a dramatic slowdown in consolidation in scrap metals and suffering by the leading players. Outside of scrap metal, consolidation news has been more positive. As the aluminum, steel, paper, and glass industries

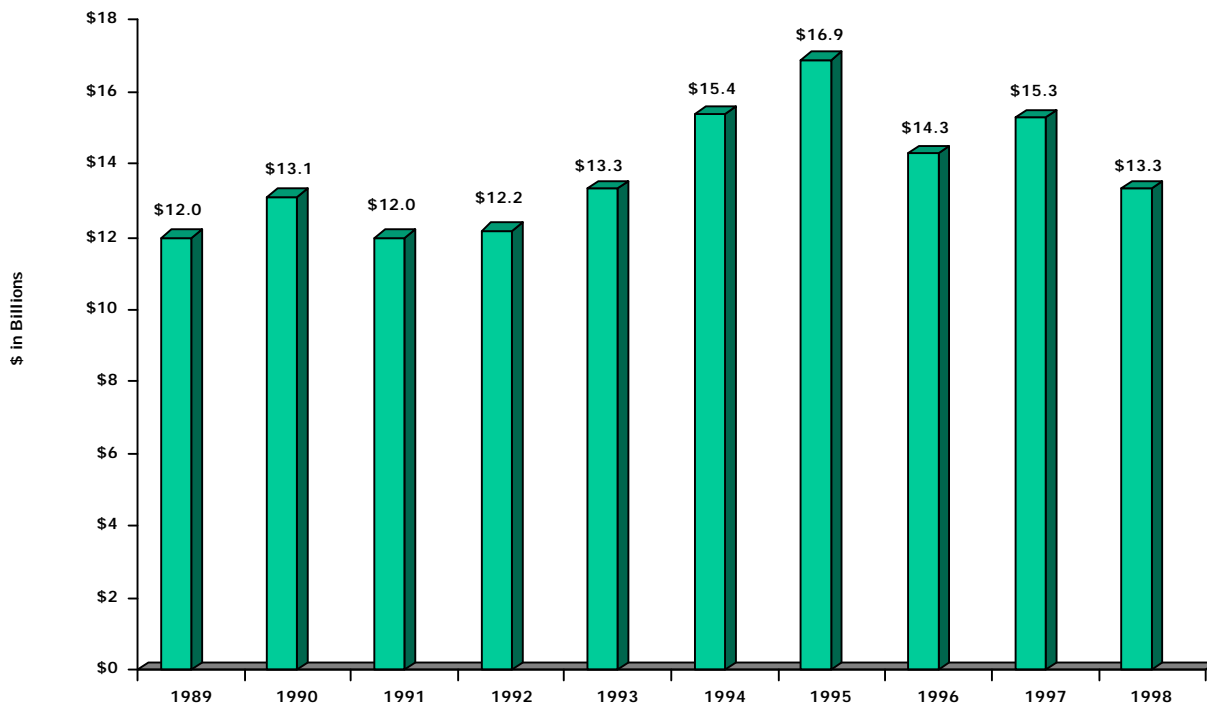


Figure 10. Revenue generation in the U.S. resource recovery market, 1989-1998. Source: *Environmental Business Journal*® XI(7) 1998 and XII(5/6) 1999.

consolidate, production capacity is reduced and efficiency increases, which benefits prices.

Recycling rates in the Solid Waste Management segment have shown a steady increase over the past decade, but some analysts question whether growth can continue because of the high cost of curbside pickup. The volatility of prices for the recovered materials (which heavily impacts the profitability of recycling components of household trash) results in a good deal of uncertainty in the resource recovery business. The recycled content of paper products has risen gradually over the past decade to just over 40%.

However, this escalation is projected to slow as a result of the poor economics of recycling and the expectation that “we have picked most of the low-hanging fruit.” Recycling rates for aluminum cans fell to 63% in 1998, down from 67% in 1997 because of the falling price for scrap aluminum and the positive state of the economy. Here again, it is believed that much of the low-hanging fruit has been picked, and not much increase in the recycling rate for aluminum cans is expected.

Recovery rates for PETE plastic also fell in 1998 to 24.7%, and thus continued their decline from their 1996 rate of 28%, because growth in collection volumes could not keep pace with the rapid growth in usage. In 1998, PETE use was up 14% but collection volumes grew only 6%, thus accounting for the falling recovery rate. HDPE recycling rates rose to 26% in 1998 from about 25% in 1997 and 24% in 1996. HDPE recycling rates are expected to continue to increase because prices for recovered HDPE have been rising in 1999.

The National Recycling Coalition expresses great optimism for the future of this segment, and they cite several major trends contributing to the positive outlook for resource recovery. These trends include:

- Considerable merger and acquisition activity driving consolidation and integration.
- Improved efficiency in collecting and processing recycled materials.



Figure 11. Revenue generation in the U.S. environmental energy sources market, 1989B1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*

- Greater use of full-cost accounting, user fees, and pay-as-you-throw systems to ensure adequate cost recovery for municipal recycling and solid waste services and to create incentives for waste reduction.
- Increased vertical integration among suppliers and end users.
- Renewed focus on producing quality recycled material feedstocks to increase revenue.
- Improved risk management to address issues of market volatility for recycled materials prices [EBJ **XI**(11/12) 1998].

Outlook

Market volatility and supply/demand fluctuations will continue to make recyclables unpredictable. Resource Recovery growth to 2002 is projected by EBI to be around 8% per annum (see Figure 3).

1.6 Environmental Energy Sources

Market Overview

Environmental Energy Sources continued in its position as the fastest-growing environmental industry segment with 12% growth in 1998 to reach \$3.04 billion in U.S. company sales (Figure 11). As in previous years, the segment was led by the photovoltaic solar and wind energy businesses, which posted more than 30% and 20% growth, respectively. Together, these two market sectors represent 58% of the segment total, with their gains offset by relatively flat or declining markets in geothermal, biomass², solar, thermal, and demand side management (DSM³) services (Figure 12). Past performance and prospects for some leading renewable energy technologies were discussed in EBJ **XI**(3) 1998 and **XII**(5/6) 1999,

²Biomass does not include wood and waste-to-energy.

³DSM refers to energy conservation, principally through more-efficient residential, commercial, and industrial heating and cooling.

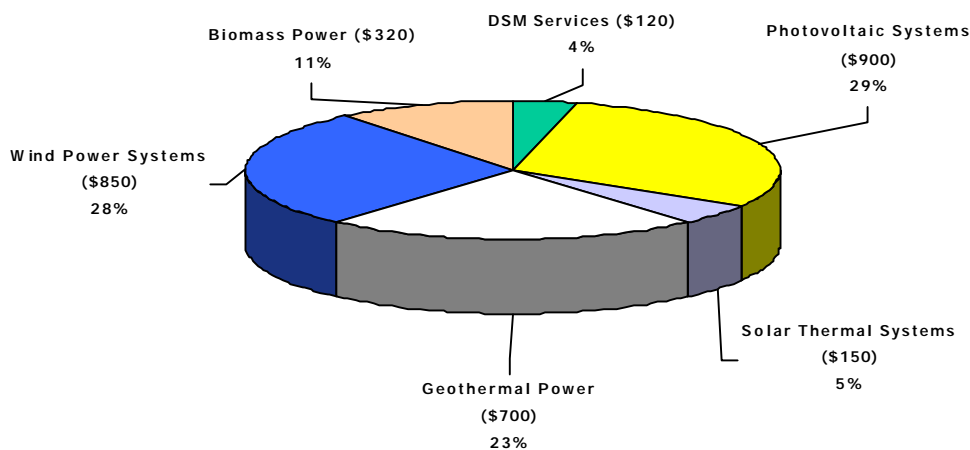


Figure 12. Environmental energy sales in 1998 (in millions of dollars). Source: *Environmental Business Journal*® XII(5/6) 1999.

from which much of the following discussion is taken.

Trends

Dramatic growth in wind and solar businesses has been mainly a function of government programs such as rooftop programs for photovoltaics, minimal requirements for renewables in certain states, and federal or state tax credits. In addition, declining costs resulting from technology advances have made wind and solar considerably more cost-effective in many more applications. Another trend with a positive effect has been the emergence of retail power with the advent of deregulation and the restructuring of the utility business. At least 36 power retailers now offer a “green power” alternative, and there is evidence of strong, clean power demand from consumers. A final driver is the trend in demand for more power autonomy, particularly from small businesses and industries, and distributed power systems now offer reliability and autonomy at affordable costs.

After a slump of several years in the United States, wind power grew rapidly in 1998 and 1999. The growth in the U.S. market is due to three factors: developers rushed to execute projects before the expiration of the federal energy investment tax credit for wind in June 1999; consumers have responded favorably to electricity suppliers offering nonpolluting energy; and the cost of wind power has fallen, from about \$0.07/kWh in 1990 to \$0.04 to \$0.05/kWh. Analysts predict these trends of tax

credits, consumer support, and cost reductions will continue.

With the resurgence of wind power in the United States, the United States joins Germany and Denmark as the wind-power leaders. Global installed generating capacity is estimated to have grown by 35% in 1998 for a total of 9,600 MW worldwide, and worldwide sales of wind equipment approached \$2 billion in 1998. Strong growth is expected to continue over the next decade.

Although wind power generates far more electricity than solar (9,600 MW worldwide in 1998 compared with 800 MW), sales of solar technology grew faster in 1998. In 1999, an estimated 200 MW of solar modules will be produced worldwide, up 31% from 153 MW in 1998. Worldwide, over \$2 billion was spent on photovoltaic systems in 1998, with U.S. company revenues totaling \$900 million. Grid-connected residential comprised the largest part of the market and is experiencing the most rapid growth because of major programs to install roof solar systems in Japan, Germany, and the United States.

Foreign markets are expected to continue growing as the result of population pressures. The domestic market is also expected to do well as homes, small businesses, and industries turn to distributed power systems to back up and supplement commercial electric power for computers, telecommunications equipment, and production machinery.

The use of biomass for energy continued its growth in 1998. Utilities are engineering or implementing methods for cofiring with biomass to meet stricter Clean Air Act emission standards for sulfur oxides and nitrogen oxides in 2000. Cofiring also has positive implications for the Consulting and Engineering segment in the demand for designing fuel-blending methods and retrofits.

Revenues from geothermal continued their decline, primarily due to reductions in the U.S. market. The overseas market is gaining in countries such as the Philippines.

The demand side is expected to play a bigger role in the future. DSM services to conduct energy audits and recommend or install energy-efficient devices or management systems have not been a high growth area in the past few years, amounting to about \$300 million. This slow growth is due to relatively low energy prices and the fact that the most obvious energy conservation measures with short payback periods have been taken. Future energy prices (and possibly global climate change concerns) will determine future energy efficiency investments.

Outlook

Electricity is essential for improving standards of living and for global economic development. A significant amount of this demand that will not be met with large conventional power plants will be available to renewable energy and distributed power—solar and wind generation, in particular. From 1993 to 1998, U.S. company revenues from photovoltaic and wind power systems more than doubled (from \$700 million to \$1750 million). This trend seems likely to continue as favorable changes occur in the way electric energy is marketed and implemented in the United States and Europe.

Regulatory changes favoring distributed power in the United States are good news in principle for renewable energy and will probably increase domestic demand somewhat. Renewable energy

must become still more cost competitive, though, to gain much market share from traditional power suppliers in this country.

Growth in renewable energy exports is driven by several factors, including (1) population pressures in Asia and Latin America, (2) shifts from fossil fuels in Europe, (3) privatization of electric utilities with consequent improvements in generating capacity and promotion of off-grid electrification, (4) increasing use of environmental criteria by multilateral funding agencies, and (5) much lower unit generating costs for renewables because of better technologies and increased sales volumes since the 1986 oil price collapse. The robust growth in renewables worldwide is expected to continue as a result of these pressures. Wind and solar electric generation should continue to lead the way. EBI predicts an average 10% annual growth in the environmental energy segment over the next 4 years.

1.7 Analytical Services

Market Overview

The Analytical Services segment is beginning to emerge from its long recession. Environmental testing revenues generated by commercial testing services showed a 1.8% growth in 1998 to \$1.14 billion following 6 years of decline (Figure 13).

Trends

The primary cause of revenue loss in the analytical services market is not sample volume, which has remained fairly steady and even grown somewhat, but price reductions of around 10% annually. This trend seems to have ended, though, with most firms reporting profits and positive cash

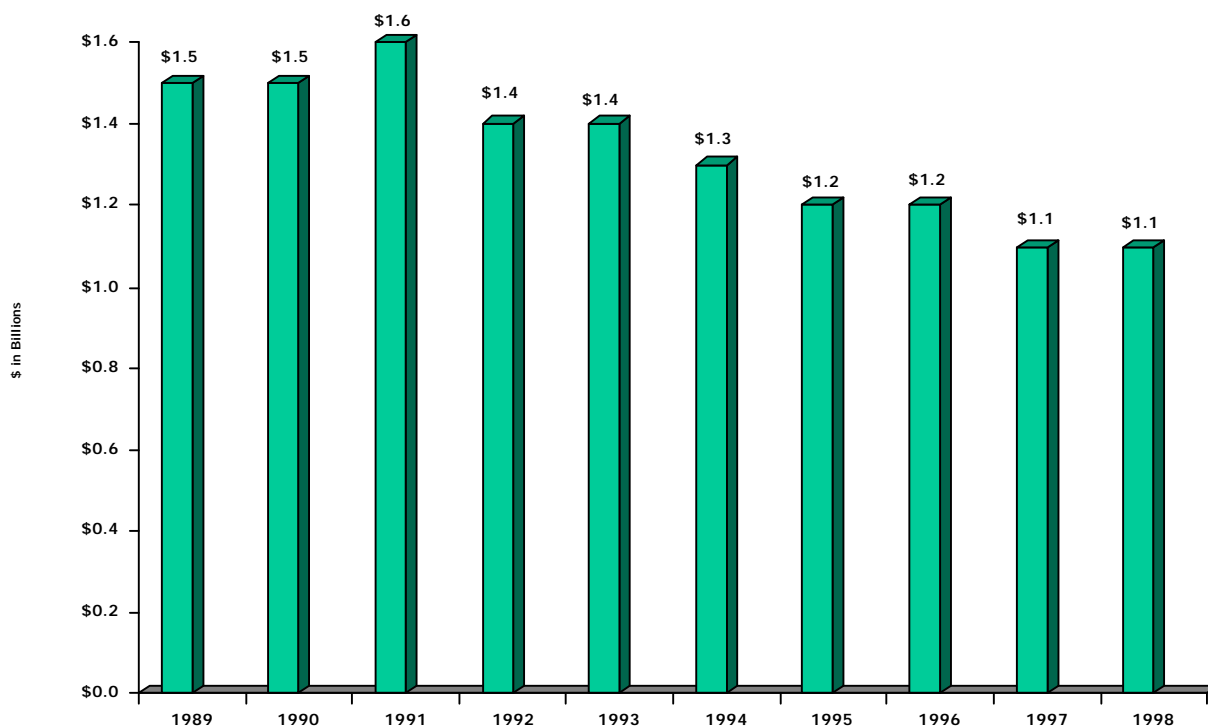


Figure 13. Revenue generation in the U.S. analytical services market, 1989-1998. Source: *Environmental Business Journal*® **XI**(7) 1998 and **XII**(5/6) 1999.

flow during the first half of 1998 [EBJ **XI**(7) 1998]. Bankruptcies in early 1998 of Nytest Environmental, American Environmental Network, and VOC Analytical have reduced capacity, which is credited with the improved performance.

Mergers and acquisitions and business closures have been rampant in the Analytical Services segment for the last several years. Only three companies in the Top 30 list in 1998 also appeared on that list in 1993. Overall, the number of commercial laboratories is down to 720 from a high of about 1,500 in the early 1990s. The attrition has continued, at a slower pace, in 1999.

One new element changing the Analytical Services segment is the Internet and the improvements it affords for data management. The Internet is expected to have a major impact on laboratories, some of which are already posting data on the Internet. Another trend in this market segment is the shift away from in-laboratory

testing toward field analysis. Both of these trends are also playing important roles in changing the Instruments and Information Systems segment [EBJ **XII**(5/6) 1999].

Outlook

EBI believes a measurable reduction in capacity and increased demand in water-related testing provides hope that the supply/demand imbalance that has plagued this segment for years will end in 1999 and 2000. Nonetheless, more closures are expected, and although pricing in general is improving, prices cannot yet be characterized as stable. International sales amounting to 3% of revenues are also an improvement and probably will increase, although prospects for growth are limited and will probably not approach 10%. Average annual growth of this market segment through 2002 is forecast to be around 0.6%, with improved growth and profits for individual companies [EBJ **XI**(7) 1998 and **XII**(5/6) 1999].

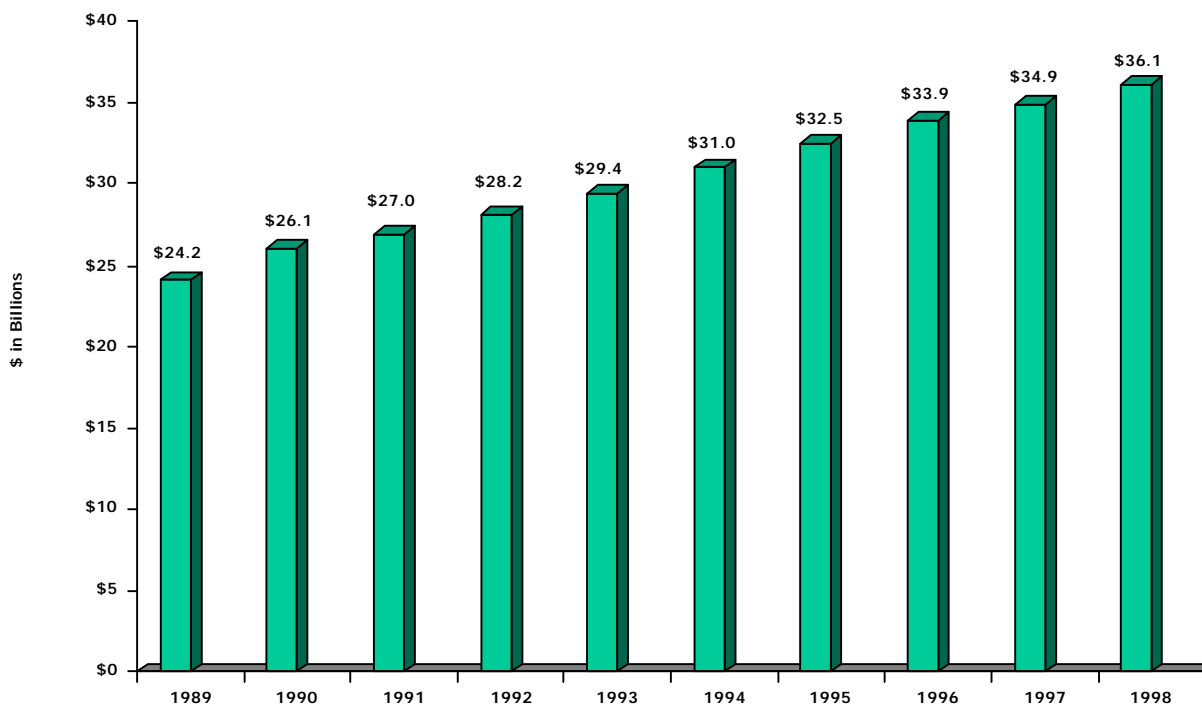


Figure 14. Revenue generation in the U.S. solid waste management services market, 1989B1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*

Table 2. Disposition of U.S. solid waste, 1989 through 1998

| | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|--------------------------------|------|------|------|------|------|------|------|------|------|------|
| Landfill (%) | 83 | 77 | 76 | 72 | 71 | 67 | 63 | 62 | 61 | 61 |
| Incineration (%) | 8 | 12 | 10 | 11 | 10 | 10 | 10 | 10 | 9 | 8 |
| Recycling (%) | 9 | 12 | 14 | 17 | 19 | 23 | 27 | 28 | 30 | 32 |
| Millions of tons | 268 | 293 | 281 | 292 | 307 | 322 | 327 | 328 | 340 | 375 |
| Growth in MSW ^a (%) | | 9 | -4 | 4 | 5 | 5 | 2 | 0 | 4 | 10 |

Source: Environmental Business Journal® XII(5/6) 1999.

^aMSW = municipal solid waste.

1.8 Solid Waste Management

Market Overview

The U.S. solid waste management business, which represents the largest segment within the U.S. environmental industry, grew 3.4% to \$36.1 billion in 1998 (Figure 14). The size of the solid waste business has become an issue of contention, with some analysts suggesting the market is actually

considerably greater than reported here. More definitive answers to the market-size question are expected in 2000.

The volume of solid waste being generated and managed also varies among data sources. The numbers given in Table 2 are from *BioCycle* magazine's 1998 State of Garbage study. They report a total of 375 million tons of municipal solid waste, a 10% increase over 1997. Recycling

received 32% of the waste stream (up from 30% the year before), with landfills accounting for 61% and incineration 8%.

Transportation (including transfer station operations) is the largest component of the market, with collection accounting for two-thirds of revenues (45% residential and 55% commercial/industrial). Disposal is 26% of revenues (82% landfill and 18% incineration), with processing for recovery making up the remainder (77% materials recovery facilities and 23% composting programs).

The industry is made up of publicly traded companies (\$18 billion or 50% of 1998 solid waste revenues), private companies (\$8 billion or 22%), and municipalities (\$10 billion or 28%). Over one-half of industry revenues fall in the hands of four very large firms. At the other end of the size spectrum, EBI estimates that there are about 4,800 private firms, with the majority being below \$2 million [EBJ XII(5/6) 1999].

Trends

Consolidation continues to be a predominant theme among solid waste management companies, with the big news being the mergers among the top players. USA Waste merged with Waste Management, then Allied Waste merged with Browning-Ferris Industries. The surviving entities, Waste Management and Allied Waste, together account for almost one-half of the total industry. This consolidation, which has been going on for several years, has changed the solid waste business. According to *Waste Age* magazine, in 1993 the top 100 firms accounted for \$19.5 billion. Now, the top three firms account for over \$20 billion. While there are still more deals in the pipeline and acquisitions of private companies are bound to continue, analysts project that the pace of consolidation will slow [EBJ XII(5/6) 1999].

Recycling rates have shown a steady increase over the past decade, as shown in Table 2. While some believe it will be difficult to continue this growth because of economics of collection and separation, others are more optimistic, citing the fact that the

population served by curbside recycling programs is less than 50%.

While U.S. solid waste leaders are focusing domestically, the market is becoming increasingly global. The French are expanding at the same time that leading U.S. firms are retracting from the global market. In 1999, the \$35-billion French firm Vivendi bought \$400-million Superior, and more acquisitions are anticipated. Browning-Ferris Industries sold much of its European interests to SITA, and Waste Management reportedly is in the process of divesting its international subsidiary.

Outlook

There is opportunity for additional consolidation in the Solid Waste Management segment, and consolidation is expected to continue, although not at its previous rate, as the large companies continue to battle for both market share and efficiency by integrating hauling and landfill operations. The collection and disposal sectors should remain strong in a healthy U.S. economy. Although recycling has been growing steadily over the past decade and now represents 32% of the market, some analysts believe it will begin to level off because of the expense of operating curbside recycling programs. Growth overall in the Solid Waste Management segment is predicted by EBI to be 3.2% per annum through 2002 [EBJ XII(5/6) 1999].

1.9 U.S. Water Industry

Market Overview

The U.S. water industry consists of three EBI market segments: Water Utilities, Wastewater Treatment Works, and Water Equipment and Chemicals. Together, these segments account for 1998 revenues of \$73.52 billion. In addition, water/wastewater revenues generated by the Analytical Services, Consulting and Engineering, and Instrument Manufacturing segments bring the total U.S. water industry market revenues to \$76.1 billion (Table 3) [EBJ XII(7/8) 1999], or

**Table 3. The U.S. water industry, 1998 through 2003
(in billions of dollars)**

| | 1998 | 1999B2003 growth (%) | 2003 |
|--|--------|----------------------------|--------|
| Vivendi Water NA | 4,610 | 21 | 12,000 |
| Separation equipment | 2,300 | -2 | 2,090 |
| Destruction/disinfection equipment | 830 | 0 | 830 |
| Biosolids equipment | 900 | -1 | 850 |
| Water treatment equipment | 4,030 | 0 | 3,770 |
| Chemical equipment | 370 | 1 | 370 |
| Delivery equipment | 6,700 | -1 | 6,370 |
| Chemicals (bulk and specialty) | 3,470 | 1 | 3,660 |
| Water delivery and chemicals | 10,540 | 0 | 10,400 |
| Contract operations | 1,390 | 18 | 3,130 |
| Consulting | 1,560 | 4 | 1,890 |
| Design engineering | 1,800 | 5 | 2,290 |
| Maintenance services | 1,230 | 6 | 1,640 |
| Services, consulting, and engineering | 5,980 | 8 | 8,950 |
| Instruments | 630 | 5 | 800 |
| Analytical services | 420 | 0 | 430 |
| Wastewater treatment works | 25,830 | 4 | 30,990 |
| Water utilities | 28,070 | 3 | 32,870 |
| Total water industry | 76,080 | 5 | 96,430 |

Source: *Environmental Business Journal*® XII(7/8) 1999.

40% of the \$190 billion environmental industry total.

Since 1990, water rates have increased about 5% per year, and this trend is expected to continue. Recent gains in wastewater rates have been less dramatic, falling in the 3 to 4% per year range. Volumes of water and of wastewater treated have remained fairly flat over the past few years. Growth in rates, the positive state of the economy, and a more competitive atmosphere in water and wastewater due to the influence of privatization have combined to foster healthy growth in the U.S. water industry.

Water Equipment and Chemicals.

Revenues in 1998 of \$19.11 billion (Figure 15) translate into 4.9% growth from 1997.

Wastewater Treatment Works.

Revenues in 1998 were \$25.58 billion, a 3.4% increase over 1997 (Figure 16). Virtually all (95%) of these revenues are in publicly owned treatment works (POTWs).

Water Utilities. This segment generated \$28.83 billion in 1998 (Figure 17), which represents a 4.8% growth over 1997 revenues. This healthy increase is due to increases in water use fees, which is virtually the sole source of income in this industry.

Farkas Berkowitz & Company defines the water quality systems market a little differently from EBI. They estimate the 1998 water market revenues as \$92 billion for North America and \$220 billion worldwide. Their breakdown by types of products and services is presented in Figure 18.

Trends

EBJ reports that important structural changes brought on by consolidation, globalization, privatization, and the Internet are occurring in the water industry. The biggest consolidation news was the acquisition of USFilter by France's Vivendi. This is but one example of the increasing globalization of firms. Privatization of water systems has slowed somewhat in the United States—due to a mind set that favors federal funding—but continues to grow rapidly internationally. Although e-commerce is in its infancy in the water industry, EBI foresees the Internet becoming a major part of the future of the water industry.

Lines between business segments in the water industry are becoming increasingly less well



Figure 15. Revenue generation in the U.S. water equipment and chemicals market, 1989–1998. *Source: Environmental Business Journal*® XI(7) 1998 and XII(5/6) 1999.

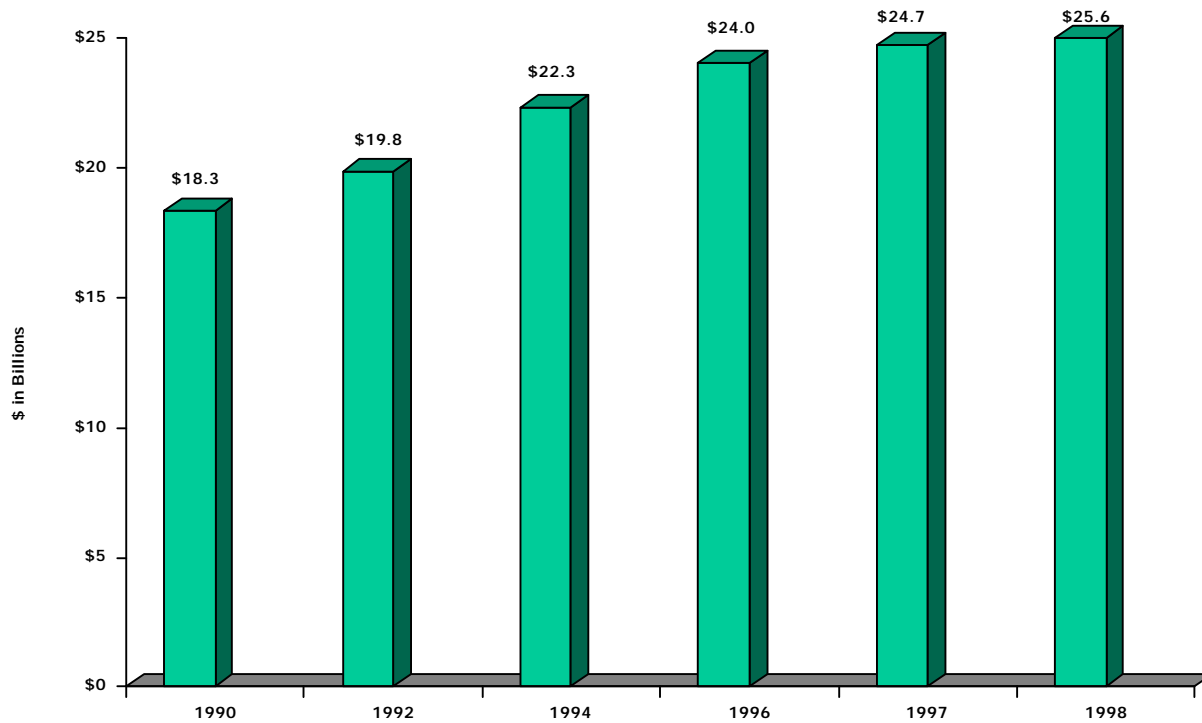


Figure 16. Revenue generation in the U.S. wastewater treatment works market, 1990, 1992, 1994, and 1996B1998. *Source: Environmental Business Journal*® XII(5/6) 1999.

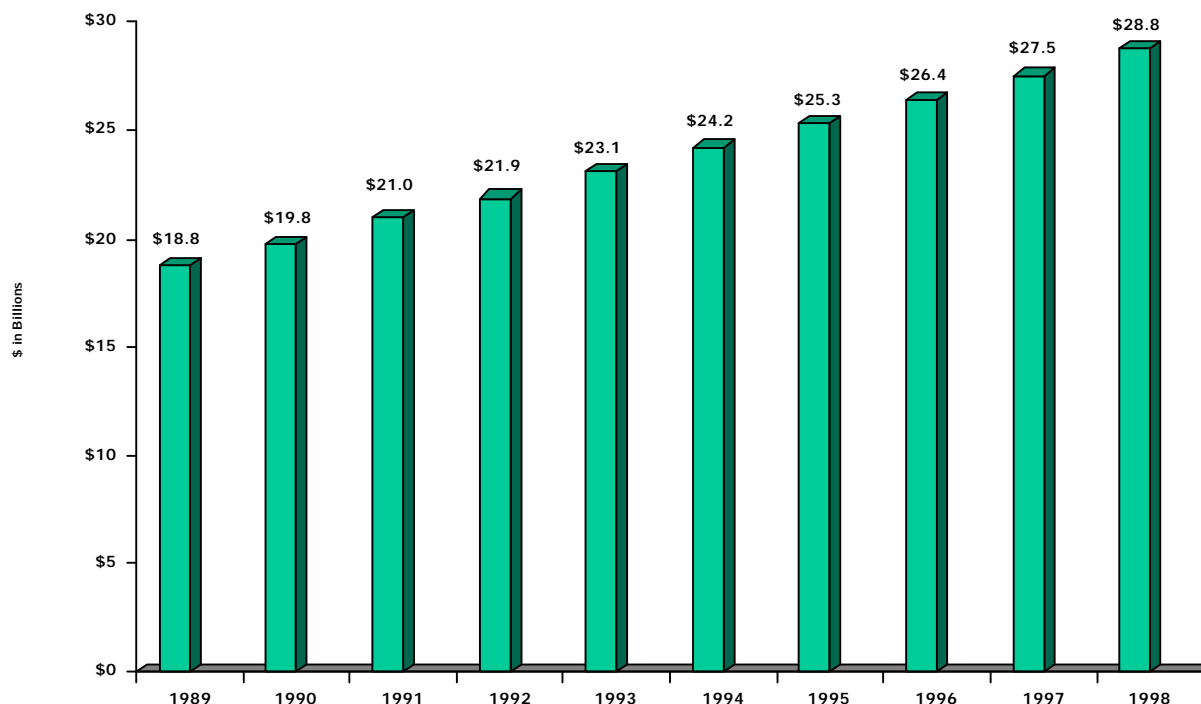


Figure 17. Revenue generation in the U.S. water utilities market, 1989–1998. *Source: Environmental Business Journal*® XI(7) 1998 and XII(5/6) 1999.

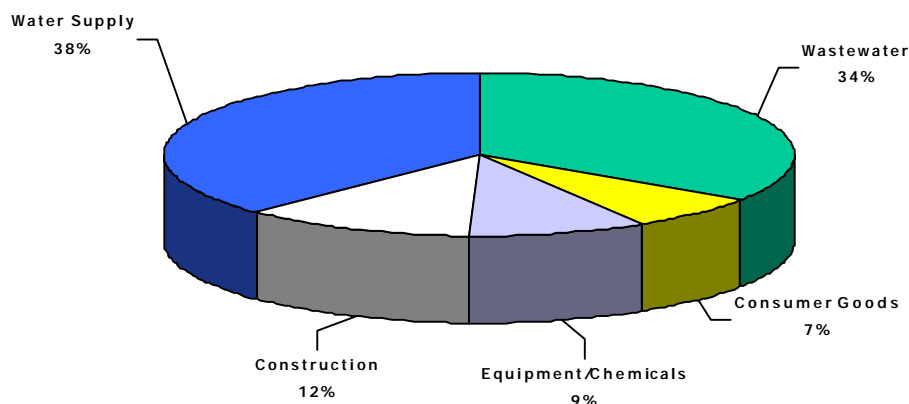


Figure 18. Distribution of the \$220 billion global water market by types of products and services. *Source: Farkas Berkowitz 1999.*

defined as the larger companies offer more and more integrated product and service contracts.

EBJ [XII(7/8) 1999] reports that water has yet to take advantage of recent technical advances. Some of the important innovations that will continue to occur include multisensor, on-line monitoring; standardized and packaged systems; low-energy membranes, disinfection, and pumping systems; smaller distributed systems; and matching quality to applications. While all of these innovations are

possible today, they will only be implemented at the pace of new systems purchases and product turnover. This is about 15 to 30 years for the centralized municipal market; however, industrial, commercial, and residential applications can be considerably faster.

The water industry continues to have strong drivers because of the fundamental requirement for water resources and the growth in stress on water resources caused by increased consumption due to population

growth and increased pollution due to industrial activities (particularly in developing countries).

In the United States, water is still heavily subsidized and therefore underpriced in real terms. Even with the price increases of 5% per year for water and 3 to 4% per year for wastewater, water remains so cheap that price is not yet a significant driver of change. EBJ believes the future of global water is a nonsubsidized, competitive, free market regulated to adjudicate for the public good.

Water Equipment and Chemicals. News in this segment includes improving demand from municipal and selected industrial segments and continued consolidation at the top of this business, most notably the acquisition of USFilter by France's Vivendi, now by far the world's largest environmental company. The joint companies will have water revenues of about \$13 billion. The success of USFilter in offering comprehensive design, build, equip, and operate packages also illustrates a trend in this business segment as other companies, both in this segment and in the related segment of Consulting and Engineering, will be forced to adopt similar strategies to keep up.

Another continuing success story is on-line automated instrumentation, which is being developed at a pace sufficient to steal demand from the Analytical Services segment almost as it materializes. The domestic market appears sound with a continued strong economy and increasing "water stress" (increasing demand and diminishing availability of water suitable for an intended use) providing a fundamental market driver both domestically and internationally. The global market is less certain as a result of the Southeast Asian and Russian economic downturns [EBJ XI(5/6) 1998].

Wastewater Treatment Works. Privatization of POTWs was expected to be more of a trend, but municipal agencies have become more competitive and have lowered rates and costs in the face of a perceived threat from private companies [EBJ XI(7) 1998].

Water Utilities. The U.S. Water Utilities segment is going through a major restructuring driven by

privatization, consolidation, and convergence. Privatization occurs when a municipality chooses to have a private sector company take over the operations of its water utility. The major drivers pushing privatization are the need for capital improvements in public water system and improved efficiencies. Consolidation is occurring to achieve economies of scale. Finally, convergence of the water, electric, and natural gas utilities, which is driven by a desire for economies of scale and stabilization of income, will also play an important role in changing the utility industry.

Outlook

Between 1998 and 2003, the U.S. water industry is expected to grow from \$76.1 billion to \$96.4 billion, which is an average growth rate of about 5% per year. In terms of individual industry market segments, EBJ predicts annual growth of the Water Equipment and Chemicals segment at a healthy 5.6% from 1998 to 2002. During the same period, the Wastewater Treatment Works segment is projected to grow at an average annual growth rate of 3.7%. EBJ forecasts average annual growth of 3.8% for the Water Utilities segment through 2002.

EBJ's vision of water's future [from EBJ XII(7/8) 1999] is as follows.

- Water and wastewater prices will continue to increase and will stabilize between 1% and 1.5% of the median annual household income—about double current prices (adjusted for inflation) by the year 2010.
- Water prices will be better rationalized to water quality, quantity, and specific end-use values.
- Water markets and water privatization will continue to grow to the point where at least 80% privatization is achieved by 2050 in the United States and even higher globally. This will be driven by (1) price stabilization (through technologies and economies of scale), (2) providing private capital to create and maintain rational water markets, (3) providing

higher quality of water and service from expanded expertise, (4) freer markets brought on by the Internet, and (5) more consistent environmental compliance.

- There will be more value-engineering of water for each specific application. Value-engineering may take into consideration water quality/volume pricing and provider financing.
- The price of water desalination will come to within raw water transport and treatment prices by 2010, thus making water availability virtually unlimited within 1,000 vertical feet of the world's oceans.

1.10 Equipment

Market Overview

The equipment industry consists of four EBI market segments: Process and Prevention Technology, Air Pollution Control Equipment, Instruments and Information Systems, and Waste Management Equipment. Together, these segments account for 1998 revenues of \$30.33 billion, an increase of 2.9% over 1997 revenues of \$29.47 billion. The fastest growth (6.7%) was in Process and Prevention Technology, also the smallest market segment at \$0.96 billion (Figure 19). Air Pollution Control Equipment (\$16.53 billion) showed a 4.7% growth while Instruments and Information Systems (\$3.30 billion) and Waste Management Equipment (\$9.54 billion) showed growths of 1.2% and 0.2%, respectively (Figures 20–22). Overall, growth in

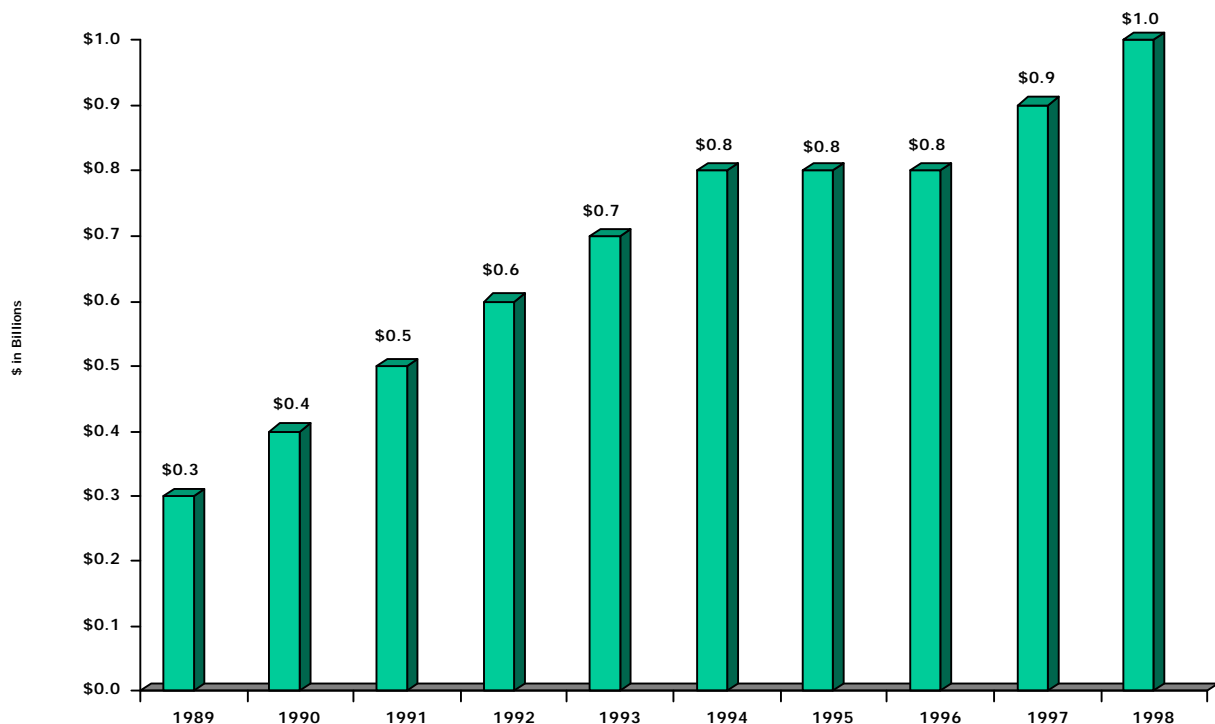


Figure 19. Revenue generation in the U.S. process and prevention technology market, 1989–1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*



Figure 20. Revenue generation in the U.S. air pollution control equipment market, 1989–1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*



Figure 21. Revenue generation in the U.S. instruments and information systems market, 1989–1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*

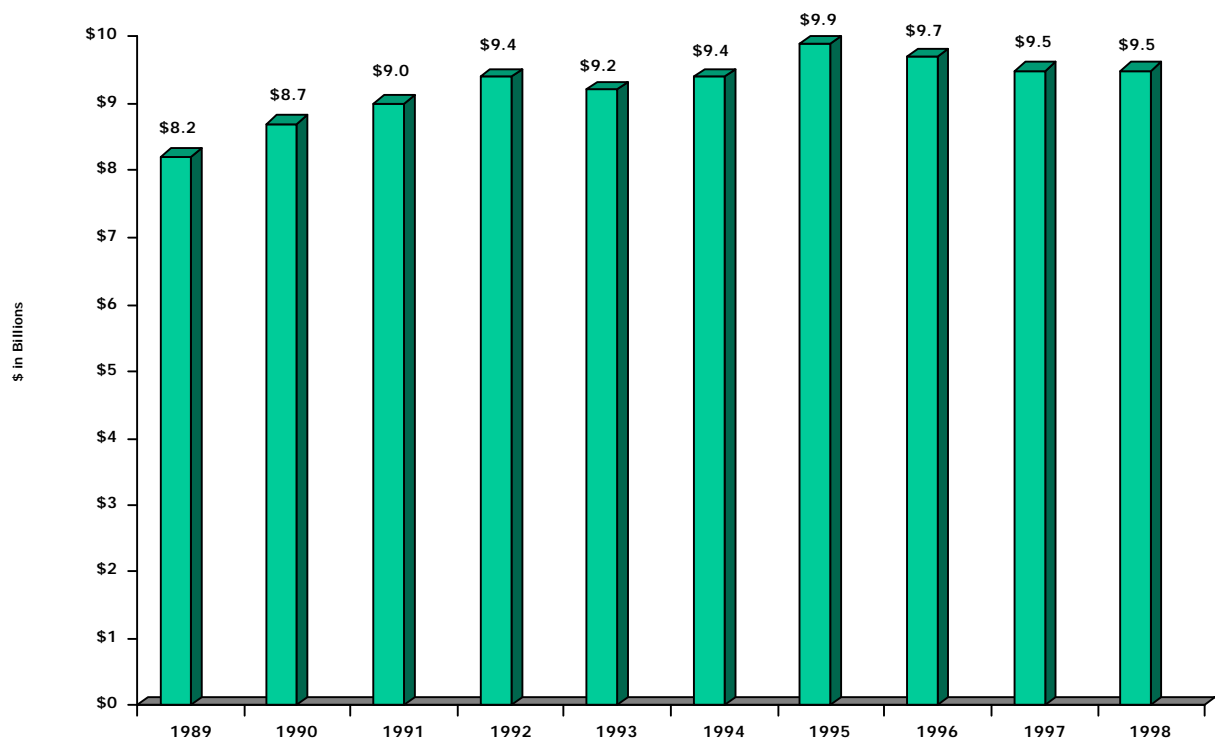


Figure 22. Revenue generation in the U.S. waste management equipment market, 1989–1998. *Source: Environmental Business Journal® XI(7) 1998 and XII(5/6) 1999.*

the equipment business was slightly better than growth in the U.S. environmental industry as a whole.

The Process and Prevention Technology segment includes many technologies intended to improve resource efficiency, principally “transition technologies” such as bioconversion and flameless oxidation. Although the smallest market segment at only \$0.96 billion, this segment has shown rapid growth and more than doubled from its 1990 size of \$0.4 billion. This growth is expected to continue.

Air Pollution Control Equipment sales by U.S. companies grew by 4.7% to \$16.53 billion in 1998. These sales were dominated by mobile emissions control devices. Mobile markets are tied closely to automotive markets, which have been healthy in recent years. The remainder of this segment is the \$3 billion U.S. market for stationary source air pollution control equipment.

The U.S. Instruments and Information Systems segment grew 1.2% in 1998 to \$3.30 billion.

Globally, sales of environmental instrumentation grew almost 6% in 1998 to reach \$2.9 billion. The U.S. represents about 43% of this market, or \$1.28 billion. This represents a growth of about 4%. U.S. manufacturers of environmental instrumentation led by three U.S. firms with strong global presence (Thermo Instruments, Hewlett-Packard, and Perkin-Elmer) make up about two-thirds of global sales. Exports represent about 55% of sales of U.S. environmental instrument manufacturers. This figure has held fairly steady over the past few years with some fluctuations due to economic crises in the leading export markets of Latin America and Asia.

The other part of the Instruments and Information Systems market segment is environmental management information systems (EMIS). EBI comments that this remains a volatile field characterized by exits and entrants, new partnerships, and mergers and acquisitions. However, strong growth in the EMIS field is anticipated. The BTI Consulting Group estimates the total EMIS market at

\$3 billion in 1998, growing at 35% with the potential to exceed \$10 billion by 2005 [EBJ XII(5/6) 1999].

Overall, Waste Management Equipment suffered through the end of a down cycle in 1998, but 1999 has shown new growth, particularly in the solid waste and recycling areas. About 60% of the \$9.5 billion waste management equipment sales is devoted to solid waste and recycling. The remainder consists of drums, tanks, and other storage units for hazardous, nuclear, and medical waste as well as incinerators, protective gear, and other equipment related to hazardous waste and remediation.

Modest growth of 1 to 2% in the solid waste and recycling subsegments balanced out a decline in the hazardous waste equipment subsegments to leave the overall Waste Management Equipment segment with virtually flat sales in 1998. Overall, the hazardous waste equipment subsegments have been flat or declining since the early 1990s due to a considerable increase in volumes of waste generated, number of sites under construction, and the relatively poor financial condition of contractors in hazardous waste and remediation [EBJ XII(5/6) 1999].

Trends

The stationary source market of the Air Pollution Control Equipment segment continues to be buffeted by changing regulations and enforcement as well as by regulatory delays. Regulations of nitrogen oxides are expected to drive this market for the next 3 years. Tighter limits on ozone concentrations by states have resulted in increased market demand for controlling nitrogen oxides and volatile organic compounds. Companies are also looking to international expansion to fuel growth, and consolidation is playing a role in this market segment, as it is throughout the environmental industry.

In the Instruments and Information Systems segment, the industry is healthy. Laboratory instrumentation sales have increased in the United States and abroad, growing at 6 to 7% globally. The market for laboratory instruments in 1999 is expected to be stronger than in 1998 due to the strong U.S. economy and recovery in Asia. The EMIS market is also projected to show significant growth, due in part to the trend of EMISs becoming less geared to

regulatory compliance and more integrated with business management systems. Firms in this segment have been caught up in the acquisition and restructuring trend that is gripping the entire environmental industry. Another important trend is the growth of the Internet, which is expected to have a strong impact on this segment. Although it is impossible to foresee all the changes the Internet will bring, one change is clear: companies are working on Internet-enabled instrumentation for remote testing, and the future could bring banks of instruments accessible over the Internet by multiple users.

The Process and Prevention Technology segment has shown rapid growth and has more than doubled from its 1990 size of \$0.4 billion; this growth is expected to continue.

In the Waste Management Equipment segment, prices for nonvehicle waste management equipment subsegments started growing in early 1999 following 2 years of sharp declines. Prices and demand were depressed due to low commodity prices and poor performance in the Resource Recovery segment and also due to "preconsolidation" effects at the major solid waste companies. The mergers and acquisitions that have been prevalent in the Solid Waste Management segment also impact the equipment market (1) because of equipment purchase delays by companies involved in mergers and acquisitions activity and (2) as a consequence of having fewer landfills.

The solid waste business went into an almost 2-year slump as companies positioned themselves to be sold and buyers refrained from spending on equipment. Now the equipment market is strong because of the release of pent-up demand from the intentional delay of capital expenditures by the major waste companies. Also fueling the growth are the strong economy and the increase in construction starts [EBJ XII(5/6) 1999].

Outlook

In the Process and Prevention Technology segment, EBI forecasts continued strong growth of about 7% annually through 2002. In the Air Pollution Control Equipment market, increased demand for nitrogen oxides and volatile organic compound control

systems is expected to continue for the next 5 or 6 years within the utility community. Automotive pollution control systems are also expected to perform well in a strong economy with good automobile sales. EBI predicts small but steady average annual growth of 2.7% through 2002. EBI

predicts continued growth in environmental Instruments and Information Systems at around 3.6% annually through 2002. The outlook for Waste Management Equipment is healthy, with EBI projecting 3.8% annual growth through 2002 [EBJ **XII**(5/6) 1999].

2

INDUSTRY TRENDS

Section 2.1 provides a comprehensive look at industry trends as seen from the perspective of the private sector. The trends of greatest significance to DOE decision makers are discussed in more detail in the sections that follow.

2.1 Overview of Trends

Market drivers (with the exception of economic growth) have been fairly stagnant, and were it not for the strong economy in 1998, the environmental industry would likely have fared considerably worse. A consistent theme among analysts is that the environmental industry is progressively less compliance driven and more market driven. Since 1991, substantial compliance with existing regulations has been reached by most major industrial sectors, and few new legislative environmental programs have been enacted and promulgated.

Regulatory drivers that fueled environmental markets in the 1970s and 1980s began to lose impetus during the Bush administration and were not rekindled during the Clinton era. Governmental spending cuts coupled with the failure of Congress to reform or reauthorize RCRA and Superfund legislation meant fewer funds for either enforcement or cleanup projects. A related historic market driver, liability, has been similarly reduced in importance. Overall environmental improvement since the 1970s, substantial compliance with existing regulations, and growing distaste for environmental regulation and litigation have shifted public opinion away from environmental issues as first

priority and thus reduced the fear of liability in otherwise environmentally proactive companies.

Table 4 shows that pollution control, remediation, and compliance-related activities account for only 27% of environmental industry revenues. Resource productivity, although growing, accounts for only 3%. Almost 70% of revenues is generated by environmental infrastructure activities (solid waste, recycling, water, and wastewater being the largest components).

The U.S. Department of Commerce report *Meeting the Challenge: The U.S. Environmental Industry Faces the 21st Century* characterizes the industry as maturing: marked by slowing growth, heightened competition, pricing pressures, and reduced profitability. But major global problems still exist, such as resource depletion, global climate change, ozone depletion, declining water quality, poor air quality, environmental health, and rising cancer rates. For example, major new expenditures by the Administration to address climate change will help underwrite an expansion of such areas of the environmental industry as renewable energy sources, clean cars, and energy-efficient buildings.

Over time, a transition of the environmental industry to address new priorities is inevitable. Also over the long term, environmental and economic policy reform and regulations will almost certainly play a role in the future of the environmental industry. But for now, environmental companies continue to look to restructuring, to mergers and acquisitions, and to the export market for sustainability.

EBI looks back and ahead to summarize some of the major environmental industry trends from the perspective of the industry. These are presented in Table 5.

Table 4. U.S. environmental industry revenues by function, 1997
(in billions of dollars)

| | Compliance/ pollution control/ remediation | Environmental Infrastructure operations and maintenance | Resource productivity |
|-----------------------------------|---|--|----------------------------------|
| Services | | | |
| Analytical services | 0.8 | 0.3 | |
| Wastewater treatment services | | 24.4 | |
| Solid waste management | | 34.9 | |
| Hazardous waste management | 5.8 | | |
| Remediation/industrial services | 6.4 | 4.8 | |
| Consulting and engineering | 9.2 | 4.3 | 1.8 |
| Equipment | | | |
| Water equipment and chemicals | 7.3 | 10.9 | |
| Instrument manufacturing | 2.3 | 1.0 | |
| Air pollution control equipment | 15.7 | | |
| Waste management equipment | 3.2 | 6.5 | |
| Process and prevention technology | | | 0.9 |
| Resources | | | |
| Water utilities | | 27.6 | |
| Resource recovery | | 15.3 | |
| Environmental energy sources | | | 2.7 |
| Total all segments | 50.7 | 130.0 | 5.4 |
| | 27.2% | 69.9% | 2.9% |

Source: *Environmental Business Journal*® XI(7) 1998.

2.2 Exports

The international market continues to be an important growth area; the number of firms competing in the international marketplace continues to increase, as do revenues. Export activity continued to grow in 1998, although certainly not at the rate seen in the past. Revenues from outside the United States were responsible for over one-half of industry growth in previous years, but in 1998 the globalization of the U.S. environmental

industry slowed due to economic setbacks facing a number of countries (Table 6).

For 5 consecutive years ending with 1997, U.S. environmental industry exports of goods and services experienced substantial (10–28%) annual growth. The \$18.2 billion in export revenues in 1997 represented 17% growth over 1996. So robust was the overseas potential that growth in exports accounted for over one-half (\$7 billion of \$13 billion) of the total growth in the U.S. environmental industry from 1994–1997. This rapid annual growth slowed to 4% in 1998, bringing total U.S. exports to \$18.9 billion in 1998.

Table 5. Environmental industry trends

| 1970s to 1980s | 1980s to 1990s | 1990s to 2000 |
|------------------------------------|-----------------------------|--------------------------|
| Industry Trends and Drivers | | |
| Regulatory proliferation | Regulatory uncertainty | Regulatory flexibility |
| EPA expanded | EPA under assault | EPA reinvention |
| Compliance | Economics | Sustainability |
| Compliance | Risk management | ISO 14000 |
| Permits | Regulatory loopholes | User/discharge fees |
| Command-and-control | Common sense | Green taxes |
| Disposal | Recycling | Design for environment |
| Site investigations | Joint and several liability | Deferred cleanups |
| Enforcement actions | Negotiated cleanups | Voluntary cleanups |
| Hazwaste dumping | Hazwaste minimization | Hazwaste imports |
| Power plant construction | Energy conservation | Global warming |
| Water pollution | Water quality | Water privatization |
| Gas guzzlers to compacts | Tin boxes to SUV tanks | Gasoline to electricity |
| Key Business Issues | | |
| Resource exploitation | Resource conservation | Resource productivity |
| Revenues | Profitability | Balance sheet |
| Billable hours | Regional office expansion | Mergers and acquisitions |
| Government studies | Large corporate clients | Infrastructure finance |
| Emissions control | Emissions modeling | Emissions trading |
| Sell on expertise | Sell on experience | Sell the company |
| Employees | Customers | Partners |
| Competitive/Social Factors | | |
| Best engineered | Lowest cost | Highest customer value |
| Regulatory know-how | Project experience | Large contract vehicles |
| My SOQ | Your ROI | Your market share |
| Physical | Chemical | Biological |
| Save the world | Make money | Remain pertinent |
| Idealism | Cynicism | Pragmatism |

Source: *Environmental Business Journal*® XI(11/12) 1998.

While the U.S. share of non-U.S. markets nudged up slightly to 6.2%, other nations stepped up efforts to penetrate the U.S. environmental market through partnership, acquisition, and direct sales. As a result, the

trade surplus declined, from \$8.5 billion in 1997 to \$8.0 billion in 1998 [EBJ XII(9/10) 2000].

Overall, the global environmental market totaled \$485 billion in annual revenues in 1998, representing

Table 6. U.S. environmental industry export performance, 1993 through 1998
(in billions of dollars)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|-------------------------------------|-------|-------|-------|-------|-------|-------|
| Global market | 423.0 | 440.0 | 453.0 | 464.0 | 474.0 | 485.0 |
| U.S. market | 160.0 | 167.0 | 172.0 | 174.0 | 178.0 | 182.0 |
| Non-U.S. market | 263.0 | 272.0 | 281.0 | 290.0 | 296.0 | 303.0 |
| % Exports | 5.7% | 6.4% | 7.9% | 8.6% | 9.8% | 10.0% |
| U.S. exports | 9.4 | 11.1 | 14.2 | 15.6 | 18.2 | 18.9 |
| Growth in U.S. environmental export | 20.0% | 18.0% | 28.0% | 10.0% | 17.0% | 4.0% |
| % U.S. Share of non-U.S. market | 3.6% | 4.1% | 5.1% | 5.4% | 6.1% | 6.2 |
| Trade surplus | 4.6 | 5.3 | 7.6 | 7.1 | 8.5 | 8.0 |

Source: *Environmental Business Journal*® XII(9/10) 2000.

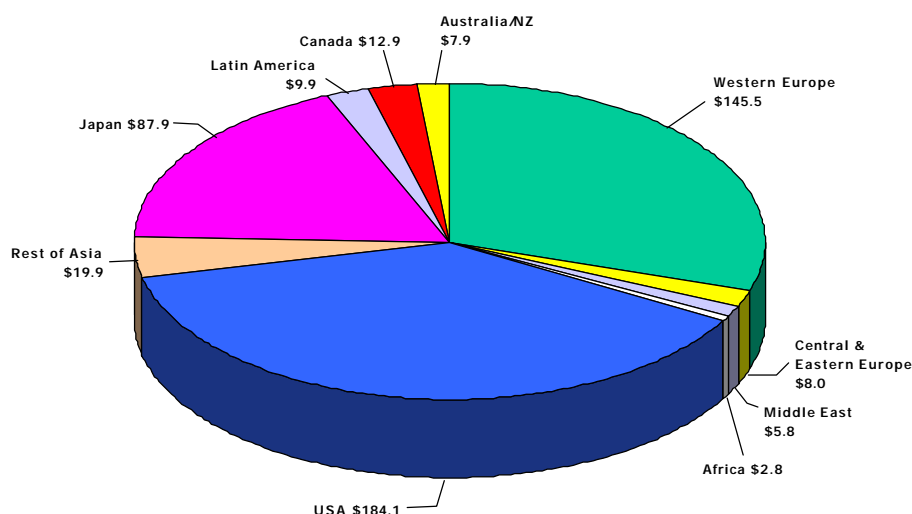


Figure 23. Distribution of the \$485 billion 1998 global environmental market. Source: *Environmental Business Journal*® XII(9/10) 2000.

2.3% growth over 1997. The regional distribution of the \$485 billion world environmental market is shown in Figure 23. 1999's growth rate appears to show an improvement to at least 3% based on interim data. The environmental market does not behave as a cohesive unit, however. Within the environmental industry, there is considerable variation between segments and between developed, developing, and transition economies [EBJ XII(9/10) 2000].

The U.S., Western Europe, and Japan represent 86% of the global market and 80% of the revenue gain from 1997 to 1998. Major

export markets of Asia and Latin America suffered from financial crises in 1998. Emerging environmental markets in Southeast Asia, which grew 8 to 20% a year in 1995 and 1996, slowed and in some cases declined in 1997 and 1998. Financial crises also took their toll on environmental exports to Latin America in 1998.

Table 7 summarizes U.S. environmental industry exports by market segment. U.S. companies are more successful in exporting equipment (particularly water/wastewater equipment and instrumentation) than services. While U.S. equipment segments make up only 26% of the industry, they account for 58% of exports. Conversely, while service segments account

Table 7. U.S. environmental industry trade balance in 1998
(in billions of dollars)

| | U.S. Industry | U.S. Market | Surplus | Exports | Imports | % Export |
|---------------------------------|--------------------------|------------------------|----------------|----------------|----------------|-----------------|
| Equipment | | | | | | |
| Water Equipment and Chemicals | 19.1 | 16.4 | 2.7 | 4.97 | 2.3 | 26% |
| Air Pollution Control | 16.5 | 15.1 | 1.5 | 2.98 | 1.5 | 18% |
| Instruments & Info. Systems | 3.3 | 2.3 | 1.0 | 1.29 | 0.2 | 39% |
| Waste Mgmt Equipment | 9.5 | 9.2 | 0.3 | 1.62 | 1.3 | 17% |
| Process & Prevention Tech. | 1.0 | 1.0 | 0.0 | 0.05 | 0.1 | 5% |
| Services | | | | | | |
| Solid Waste Management | 36.1 | 35.6 | 0.5 | 0.86 | 0.4 | 2% |
| Hazardous Waste Mgmt | 5.7 | 5.9 | -0.2 | 0.13 | 0.3 | 2% |
| Consulting & Engineering | 15.8 | 14.5 | 1.3 | 1.81 | 0.5 | 11% |
| Remediation/Industrial Services | 11.0 | 10.8 | 0.2 | 0.42 | 0.2 | 4% |
| Analytical Services | 1.1 | 1.1 | 0.1 | 0.05 | 0.0 | 5% |
| Water Treatment Works | 25.6 | 27.1 | -1.5 | 0.28 | 1.8 | 1% |
| Resources | | | | | | |
| Water Utilities | 28.8 | 30.2 | -1.4 | 0.09 | 1.5 | 0.3% |
| Resource Recovery | 13.3 | 10.9 | 2.3 | 2.58 | 0.2 | 20% |
| Environmental Energy | 3.0 | 1.8 | 1.2 | 1.76 | 0.5 | 58% |
| Total | 189.8 | 181.8 | 8.0 | 18.9 | 10.9 | 10.0% |

Source: *Environmental Business Journal*® XII(9/10) 2000.

U.S. Industry is revenues generated by U.S. companies worldwide.

U.S. Market is revenues from U.S. customers.

Exports do not include ownership of overseas companies but do include repatriated profits.

for more than 50% of industry revenues, they are only 19% of exports [EBJ XII(9/10) 2000].

Foreign competitors enjoy an advantage in global water/wastewater management and operating contracts. This is also increasingly true in the Solid Waste Management segment, where the United States has traditionally enjoyed the advantage [EBJ XI(7) 1998]. Control of water and solid waste service segments has an effect on equipment and supply sales. When the equipment that supplies the waste and water infrastructure is added to

the service totals, the total represents more than two-thirds of the global market where the U.S. environmental industry is losing competitiveness. The U.S. environmental industry remains fairly well positioned for the remaining third of the market, as it leverages its comparative advantage in consulting & engineering, remediation, instruments and information technology, and services. Opportunities in automation for treatment systems and monitoring, advanced design, biological systems, materials reuse and efficiency, and use of the Internet are all areas in which U.S. companies should be in good position to gain market share [EBJ XII(9/10) 2000].

Sales of alternative energy technologies are expected to grow, both domestically and abroad, in 1999 as the result of electricity market restructuring in both the United States and Europe. A number of other drivers point to a healthy renewable energy market, particularly overseas [EBJ XI(3) 1998]:

- population pressures in developing countries of Asia and South America;
- European economic policies that encourage energy conservation and decreasing reliance on fossil fuels;
- upgraded overseas generating capacities and promotion of off-grid electrification programs that result from foreign privatization of electric utilities;
- broader environmental criteria used by multilateral financing agencies; and
- significantly lower cost-per-unit-output from renewable energy systems, stimulated by technology advances and increases in manufacturing volume since the collapse of oil prices in 1986.

Another strong segment of international market growth is environmental Consulting and Engineering, for which both the number of firms and total revenue generated from overseas contracts are increasing (Table 8). Growth rates are forecast to be 25 to 33% over the next few years, (which is better than the domestic forecast), although the magnitude of growth is partly an artifact of the small revenue base. The downside of this overseas market is that profit margins are only 4 to 5%, and these are probably overstated. Most firms probably break even, at best, on international contracts because of the greater necessity for management oversight, delayed payment schedules, and greater capital investments. Profitability appears to be rising, however, which is indicative of the inherent overseas market potential.

Table 8. International trends in environmental consulting and engineering

| | 1996 | 1997 | 1998 (forecast) |
|--|-------|-------|--------------------|
| U.S. firms with international revenues | 72 | 76 | 80 |
| Total international revenue (\$ in billions) | \$1.2 | \$1.5 | \$2.0 |
| Average operating margin | 4.0% | 5.0% | 5.5% |

Source: Zofnass and Avelini, "Cause for (Mild) Optimism—Environmental Engineering and Consulting Firms Report on the Year and Forecast the Future of the Industry," available on the World Wide Web at URL <http://www.envirobiz.com> (printed on February 7, 2000).

The McIlvaine Company projects strong growth in the European remediation market. They predict that the market for remediating contaminated groundwater and soil in the Europe/Africa region will rise from \$6.9 billion in 1997 to just under \$9 billion in 2002. Landfill remediation alone will account for \$2.2 billion in 2002, they predict, whereas cleanup of petroleum-contaminated sites is expected to account for just under \$2 billion in revenues. The third-largest segment, contaminated military sites, is projected to account for \$941 million.

There are several driving forces behind this growth. The European Union environment ministers have approved a long-term plan to clean up contaminated rivers, lakes, and coastal waters throughout member nations. Another driving force is the European Bank for Reconstruction and Development, which is increasing its support of environmental projects. Accession into the European Union is a driving force for remediation in Poland, Hungary, the Czech Republic, and other countries of Central and Eastern Europe [McIlvaine 1999].

Opportunities in overseas water and wastewater industry segments may have the greatest real potential of all. Water is unique in that it is an absolutely essential resource, and the demand for clean water and wastewater treatment is increasing rapidly in developing countries. Parts of Asia and Southeast Asia

(excluding Japan, Australia, and New Zealand) are among the fastest growing (15% per annum, or greater) global water/wastewater quality equipment markets. EBI estimates that the water/wastewater market in these countries was around \$9 billion in 1996, and the World Bank projects growth of this market to \$153 billion by 2004. About one-half of the \$9 billion generated in 1996 was from public-sector water utilities, and these are being privatized to some extent, generating some of the world's largest management contracts. France and the United Kingdom have, so far, been the most successful players in this arena [*U.S. Water News Online*].

Financial crises in the major export markets of Asia and Latin America took their toll on environmental exports in 1998. In 1998, East Asia became engulfed in a deep financial crisis that caused a corresponding collapse of the environmental market. The outlook for environmental markets in Asia looks more promising in 2000 than in the previous three years. EBI's *Asian Environmental Business Summary* concludes that a return to the sky-high growth of the last decade may still be far in the future for many of Asia's markets, but these economies will bounce back in time and the environmental markets will emerge even stronger than ever.

The focus now is on essential infrastructure, such as energy, water supply, sanitation, and waste management. With external assistance, public sector agencies have long-range multimillion dollar spending programs and are encouraging private sector investments. Multinational companies are still pursuing their own internal environmental compliance agendas, and Asia's global exporters are

compelled to address ISO requirements [EBI *Asian Environmental Business Summary* 1999].

Latin America's economic performance in 1998 and 1999 was also disappointing (though certainly not as much as Asia's), but positive economic growth of 3 to 4% is projected for 2000. This is a substantial improvement from 1999's regional decline of 0.4%. Despite economic pressures, the region continues to be a strong importer of products from industrialized countries, and imports of environmental goods and services continue to comprise an important share of overall demand. CG/LA Infrastructure reports that the significant issue from the environmental perspective is that the economic downturn had a significantly negative impact on projects. Countries focused on exports for growth and were not willing to enforce burdensome environmental regulations on industrial producers.

Looking at Latin America's individual environmental market segments, water and wastewater represent the largest market segment and most significant business opportunity for U.S. environmental companies. In the hazardous waste area, political opposition and regulatory uncertainty are impeding the development of large third-party hazardous waste facilities. The market is focused on working with individual clients on-site to reduce, recycle, store, and improve the management of hazardous wastes. Solid waste provides an ongoing opportunity to U.S. environmental companies; however, European firms are aggressively pursuing this sector. Finally, comprehensive air pollution programs are underway in many major Latin American cities and provide another market opportunity [CG/LA Infrastructure 1999].

According to EBI's Andrew Paterson [Paterson 1998], the sharp decline of overseas environmental markets in developing countries of Asia, South America, and Eastern Europe following the 1998 economic downturn underscores the importance of finance (rather than regulatory pressures) in these markets.

2.3 Consolidation

Ongoing consolidation, effected through mergers and acquisitions, continues to be perhaps the single clearest trend in the environmental industry. Companies are looking for growth and diversification opportunities through acquisitions. Consolidation also holds the promise of greater integration and the ability for merged companies to reduce costs and operate more efficiently.

The Environmental Financial Consulting Group reports that while the industry reports an average internal growth rate of 4%, the growth expected to come from acquisition is 10%. They conclude that most of the growth for environmental firms is coming from acquisitions, not internal growth. They also report that consolidation in this industry has been so great that the top 20 firms, which represented approximately 28% of revenues of the overall industry in the early 1990s, accounted for 56% in 1997 and were projected to grow to 63% in 1998 [Zofnass and Avelini].

Factors that influence business owners to sell are related to the maturity of the market and to market contraction in many segments.

- Poor performance and increased competition have led to acquisition transactions in search of cost savings and equity maximization.
- Companies founded as long ago as the 1970s now have owners near retirement age who want to liquidate their assets.
- Larger or diversified sellers (including companies like ABB, Dow, General Electric, and Westinghouse) have divested business components in the environmental industry either because of poor performance or to concentrate on core competencies.

- Many companies want to be matched with complementary business units to serve customers who increasingly prefer integrated services.

Larger companies are encouraged to acquire for a related set of reasons.

- Acquisitions provide broader technological and service capabilities and broaden the customer base, allowing a company to remain competitive and grow.
- Acquisition is a convenient way, especially for public companies in an economy with plentiful cheap capital, to maintain or increase revenue and earnings growth for their stockholders.
- Some environmental companies (e.g., USFilter) have begun to use acquisitions as a corporate strategy for growth.

Overall, significant consolidation occurred over the last several years, and this trend accelerated during 1998 and the first half of 1999. Environmental industry mergers and acquisitions are expected to continue for the foreseeable future.

2.4 Contract Reform

DOE expenditures on commercial firms for site remediation were \$1.85 billion in 1998 (30% of the total U.S. site remediation market). This represents an almost 7% increase over 1997 and is projected to continue to increase over the coming years. To accomplish the cleanup work ahead while reducing overall cost to the government, DOE is pursuing innovative contracting mechanisms incorporating best practices and expertise from the private sector.

In particular, DOE is pursuing an “optimal contracting strategy” that includes establishing business terms and conditions for contracted work, allocating risk, and providing incentives. The risk allocation strategy involves balancing technical risks (e.g., new technology and process performance) with operational/business risks (e.g., program management and financial risk) and people risks (e.g., legal, regulatory, and stakeholder

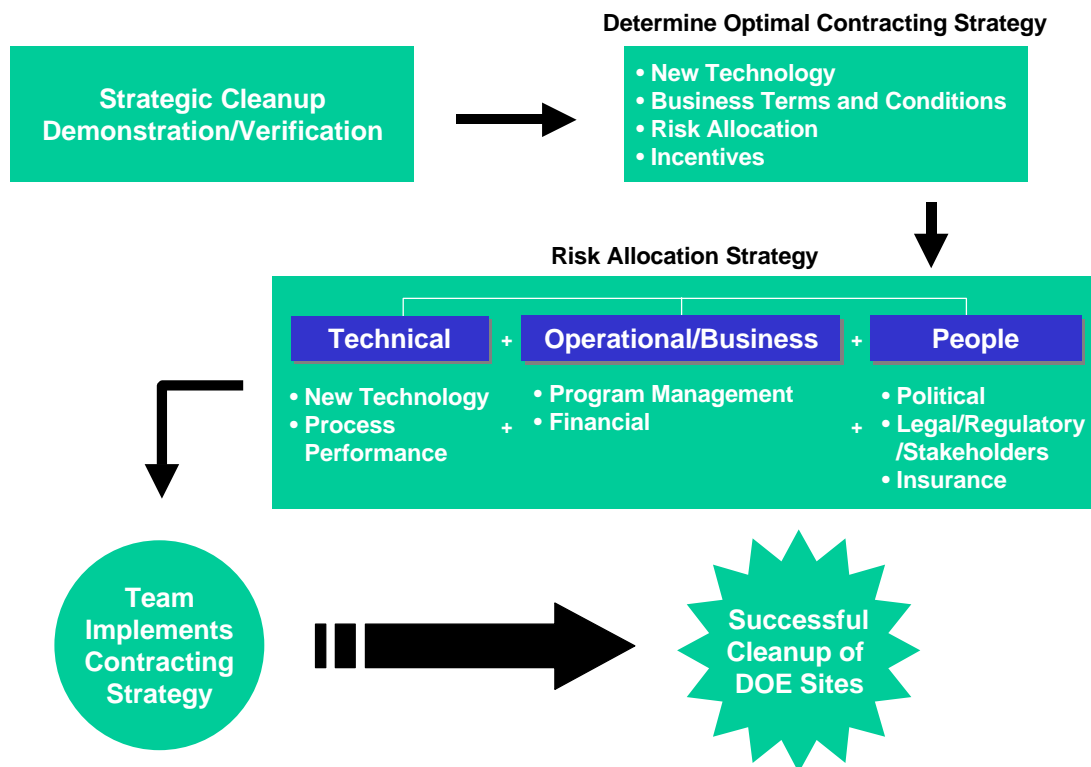


Figure 24. DOE's optimal contracting strategy. *Source:* Howes 2000.

issues). DOE's optimal contracting strategy is depicted in Figure 24 [Howes 2000].

Much has been made of the erosion in environmental venture capital investments. For example, environmental venture capital fell drastically from its \$94-million peak in 1992 to \$29 million in 1995 (Lerner 1997). For the most recent 12-month period (fourth quarter 1998 through third quarter 1999), environmental-sector investments by venture capitalists totaled \$7.7 million [PricewaterhouseCoopers Money Tree Report 1999].

However EBI's Andrew Paterson comments [Paterson 1998] that the loss of venture capital in the environmental market is not necessarily a negative development but rather an acknowledgment that the environmental technology market is a "project" industry rather than a "product" industry favored by venture capitalists. Recent shifts toward

privatization establish factors for tracking projects and evaluating their success, which favors debt financing (by instruments such as banks or the bond market). Venture capitalists tend to seek investments with a potential for return of 5 to 10 times the investment amount over a short period of time because of the high risk associated with new technologies. Many environmental technologies do not represent potential high growth products that attract equity financing without collateral. Table 9 provides a comparison of venture capital and project financing.

2.5 ISO 14000

The ISO 14000 series of international standards addresses industry management of day-to-day operations as they affect the environment [ISO 1998]. The standard to which most companies are certified is ISO 14001, which specifies the requirements of an environmental management system that can be integrated with other management requirements to

Table 9. Comparison of venture capital and project finance mechanisms

| | Venture capital | Project finance |
|-------------------------------------|--|---|
| What is financed? | <ul style="list-style-type: none"> • R&D manufacturing | <ul style="list-style-type: none"> • Project cash flow |
| Governmental roles | <ul style="list-style-type: none"> • Grant tax benefits • Fund “precompetitive” R&D (e.g., ARPA, NIH, NSF) • Enforce financial disclosure | <ul style="list-style-type: none"> • Grant concessions • Modify land-use rules • Offer liability caps • Protect property rights |
| Type of finance | <ul style="list-style-type: none"> • Equity, little collateral | <ul style="list-style-type: none"> • Debt, some collateral |
| Source of funding | <ul style="list-style-type: none"> • Pension funds (equity) | <ul style="list-style-type: none"> • Bond market, banks |
| Market growth | <ul style="list-style-type: none"> • High growth • New technology | <ul style="list-style-type: none"> • Single project, not a market |
| Business objective | <ul style="list-style-type: none"> • Equity appreciation | <ul style="list-style-type: none"> • Project completion |
| Profit source | <ul style="list-style-type: none"> • Sale of growth stock | <ul style="list-style-type: none"> • Profit margin on project • Sale of real estate or recycled materials |
| Regulatory impact on market | <ul style="list-style-type: none"> • Slight regulation (FDA, FCC, OSHA) | <ul style="list-style-type: none"> • Heavy regulation (EPA, states) |
| Failure rate | <ul style="list-style-type: none"> • High | <ul style="list-style-type: none"> • Very low |
| U.S. venture capital 1997 | <ul style="list-style-type: none"> • \$10 billion | |
| Average U.S. venture capital, 1990s | <ul style="list-style-type: none"> • \$4 billion/year | |
| U.S. REIT financing, 1997 | | <ul style="list-style-type: none"> • \$20 billion to \$30 billion |
| Average U.S. REIT, 1990s | | <ul style="list-style-type: none"> • \$5 billion/year |

Source: Andrew Paterson, Environmental Business International, Inc., personal communication, August 1998.

Note:

ARPA = Advanced Research Projects Agency (DOD).

NIH = National Institutes of Health.

NSF = National Science Foundation.

FDA = U.S. Food and Drug Administration.

FCC = Federal Communications Commission.

OSHA = Occupational Safety and Health Administration.

EPA = U.S. Environmental Protection Agency.

REIT = Real Estate Investment Trust.

achieve environmental and economic goals.⁴

The commercial benefit of ISO 14000 standards is expected to be found in international consistency in national rules, labels, and methods that promote predictability

and consistency and minimize trade barriers [ASQ 1999]. ISO 14000 is also expected to provide a framework for moving beyond environmental compliance and to contribute directly to the sustainability for which the environmental industry is now searching.

⁴Other standards in the series tend to address issues such as certification mechanics (e.g., auditing techniques), which are not the direct day-to-day concern of the certified facility, or to provide implementation guidance.

In 1998 there were about 200 U.S. facilities in 34 states with ISO 14001 certification [globeNet™ 1999], but the United States lags behind most other developed countries in commitment to the international standards.

Europe is especially involved in the implementation of ISO 14000, as shown in Figure 25, and adoption of the standard by U.S. companies is considered by many to be a major factor in the growth of future revenues from exports.

2.6 Regulatory Reform

In recent years, there have been a number of reports on how the United States should improve its environmental protection system from sources including the National Academy of Public Administration, the President's Council on Sustainable Development, the Aspen Institute, the Presidential/ Congressional Commission on Risk Assessment and Risk Management, the Yale Center for Environmental Law and Policy, the Enterprise for the Environment, the National Environmental Policy Institute, and the U.S. Department of Commerce. While recognizing the significant environmental successes that have been brought about by the existing

system, all of the reports call for evolutionary changes in the nation's environmental protection system (creating a so-called "next generation" of environmental policy) to enable the United States to meet the environmental challenges ahead.

The reports recommend improving the current system by requiring, among other things, that pollution be limited not by the "best available technology" but by limits determined by human and ecological health; that industry create products and processes that generate less waste and that channel remaining wastes back into production rather than into the environment; and that society find ways to reduce the environmental impact of small, numerous, diverse sources. To accomplish this, these reports recommend that the environmental protection system evolve toward:

- a more performance-based, information-rich, technology-spurring, flexible, and accountable regulatory system;
- a broader array of policy tools that promote continuous environmental improvement, including environmental taxes, subsidy reform, emissions trading, and information disclosure; and

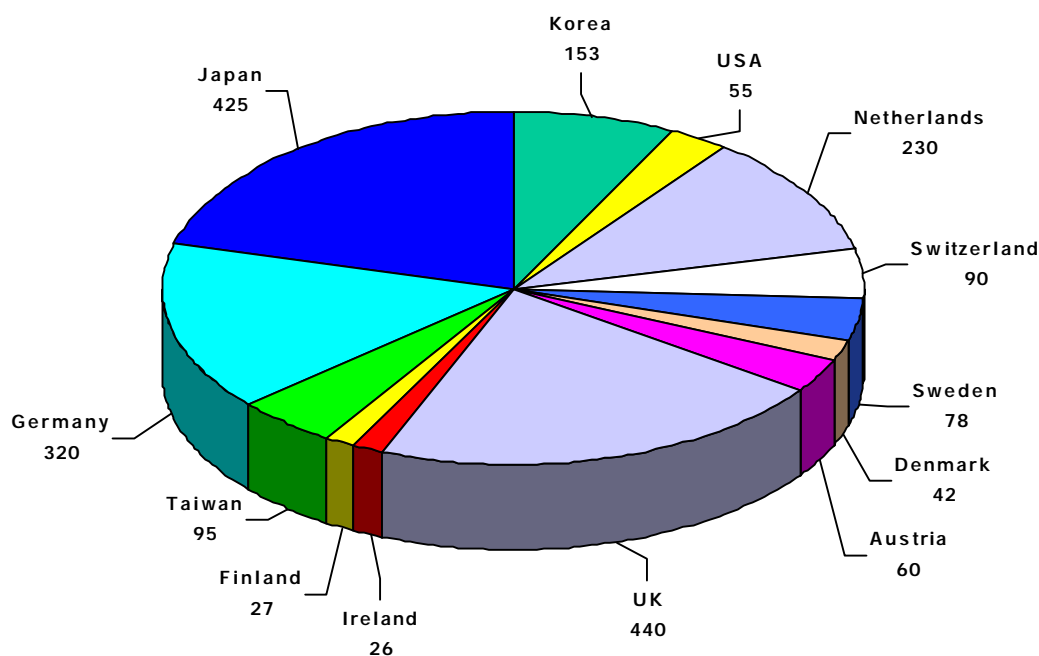


Figure 25. International ISO 14001 registrations of environmental management systems. Source: globeNet™, printed from the World Wide Web on February 2, 1999.

- stronger private sector management systems that internalize the same stewardship ethics embodied in environmental statutes [Hausker 1998].

For example, the President's Council on Sustainable Development stated, "[F]or the last 25 years, government has relied on command-and-control regulation as its primary tool for environmental management. In the future, society needs to adopt a wider range of strategic environmental protection approaches that embrace the essential components of sustainable development." The President's Council endorsed the "growing consensus that the existing regulatory system may be greatly improved by moving toward performance-based policies that encourage pollution prevention. Regulations specifying performance standards based on strong protection of health and environment—but without mandating the means of compliance—give companies and communities flexibility to find the most cost-effective way to achieve environmental goals. In return for this flexibility, companies can pursue technological innovation that will result in superior environmental protection at far lower costs. But this flexibility must be coupled with accountability and enforcement to ensure that public health and the environment are safeguarded."

Other issues addressed by these reports include the need for greatly improved information and data systems; more integrated, multimedia approaches to regulation; more encouragement of pollution prevention; and more streamlined reporting requirements. The reports argue that such changes will result in more environmental protection, lower cost, and more technological innovation [Hausker 1998].

2.7 Resource Productivity

Improved resource use through recycling and environmental energy sources are projected to be important growth areas for the future.

Recycling has seen continued growth and is now an established industry as major industries have become dependent on recycled materials for part of their manufacturing feedstocks and as municipal governments have integrated recycling into their solid waste management programs. While the environmental benefits of recycling are well understood, the industry has been striving to improve the economics through greater efficiency and cost-effectiveness.

The National Recycling Coalition reports that the recycling industry is becoming more efficient by better integrating its operations. Merger and acquisition activity in the industry has been rampant, and this will allow companies to better integrate their services and continue to demonstrate profitability for investors. Greater efficiency in all sectors of the industry and innovative risk management strategies (such as hedging contracts) will minimize the risks posed by fluctuating commodity prices. New sources of capital and innovative financing strategies (such as asset-based lending, factoring, lease financing, and Small Business Administration loan guarantee programs) will improve recycling entrepreneurs' access to capital while expanding end markets for recycled materials collected by municipalities and private sector recyclers [EBJ XI(11/12) 1998].

Renewable energy has been the most rapidly growing market segment, and strong growth is expected to continue in both the United States and global markets. Photovoltaic solar and wind energy businesses are expected to continue to lead the growth. Dramatic growth in wind and solar has been mainly a function of government programs such as rooftop programs for

photovoltaics, minimal requirements for renewables in certain states, and federal or state tax credits. In addition, declining costs resulting from technology advances have made wind and solar energy considerably more cost-effective in many more applications.

Another trend with a positive effect has been the emergence of retail power with the advent of deregulation and the restructuring of the utility business. At least 36 power retailers now offer a “green power” alternative, and there is evidence of strong clean-power demand from consumers. A final driver is the trend in demand for more power autonomy, particularly from small businesses and industries. Distributed power systems now offer reliability and autonomy at affordable costs [EBJ **XII**(5/6) 1999].

2.8 The Internet

We would be remiss if we did not mention the Internet, which is transforming the environmental industry, as it is all other industries. The full range of changes it will bring is impossible to predict, although already analytical laboratories and instrumentation providers are changing to take advantage of the Internet. For example, companies are working on Internet-enabled instrumentation for remote testing, and the future could bring banks of instruments accessible over the Internet by multiple users. The Internet also offers benefits for data management (e.g., posting data on the Internet) as well as for information systems.

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CRONYMS

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| DOD | U.S. Department of Defense |
| DOE | U.S. Department of Energy |
| DSM | demand side management |
| EBI | Environmental Business International, Inc. |
| EBJ | <i>Environmental Business Journal</i> ® |
| EMIS | environmental management information systems |
| EPA | U.S. Environmental Protection Agency |
| GDP | Gross Domestic Product |
| HDPE | high-density polyethylene |
| PETE | polyethylene terephthalate |
| POTW | publically owned treatment works |
| RBCA | risk-based corrective action |
| RCRA | Resource Conservation and Recovery Act |

